Course overview and preparations

Lecture 0

Module 0

Operating systems 2018

1DT044 and 1DT096

2018-01-15 karl.marklund@it.uu.se Uppsala University

Course responsible lecturer

Karl Marklund

karl.marklund@it.uu.se

Room P1440

Slides for all lectures will be added to the following GitHub repository right before the lecture starts.

https://github.com/uu-os-2018/slides

Course code	Course name	Abbreviation	Credits (hp)	Grading system	Programs
1DT044	Operating systems I	OS	5	Fail (U), 3, 4, 5	IT, F, FRI
1DT096	Operating systems and process oriented programming	OSPP	15	Fail (U), 3, 4, 5	KandDv

Both courses includes an introduction to fundamental operating system concepts. The main difference between the two courses is, that 1DT096 (OSPP) also includes an introduction to various concurrency programming paradigms and ends with a large group project.

Entry requirements

The entry requirements for both courses (1DT044 and 1DT096) states that you should be familiar with computer architecture and programming.

Course code	Programs	Entry requirements
1DT044	IT, F, FRI	Computer programming (first and second course), Computer architecture (first course).
1DT096	KandDv	60 credits including Computer architecture and Imperative and object-oriented methods of programming.

Modules

The content for the two courses is organized into modules. Modules 0-7 are part of both OS (1DT044) and OSPP (1DT096) whilst modules 8 and 9 are part only of the OSPP (1DT096) course.

Module	Description
0	Course overview and preparations.
1	Fundamental concepts.
2	The process concept and inter process communication. File descriptors, standard streams, and I/O redirection.
3	CPU Scheduling.
4	Threads, synchronization and deadlock.
5	Memory management, files and file systems
6	Case study
7	Written exam
8	Erlang and other concurrent programming models.
9	Group project.

Both **OS** and **OSPP**

OSPP only

Language for modules 0 - 7

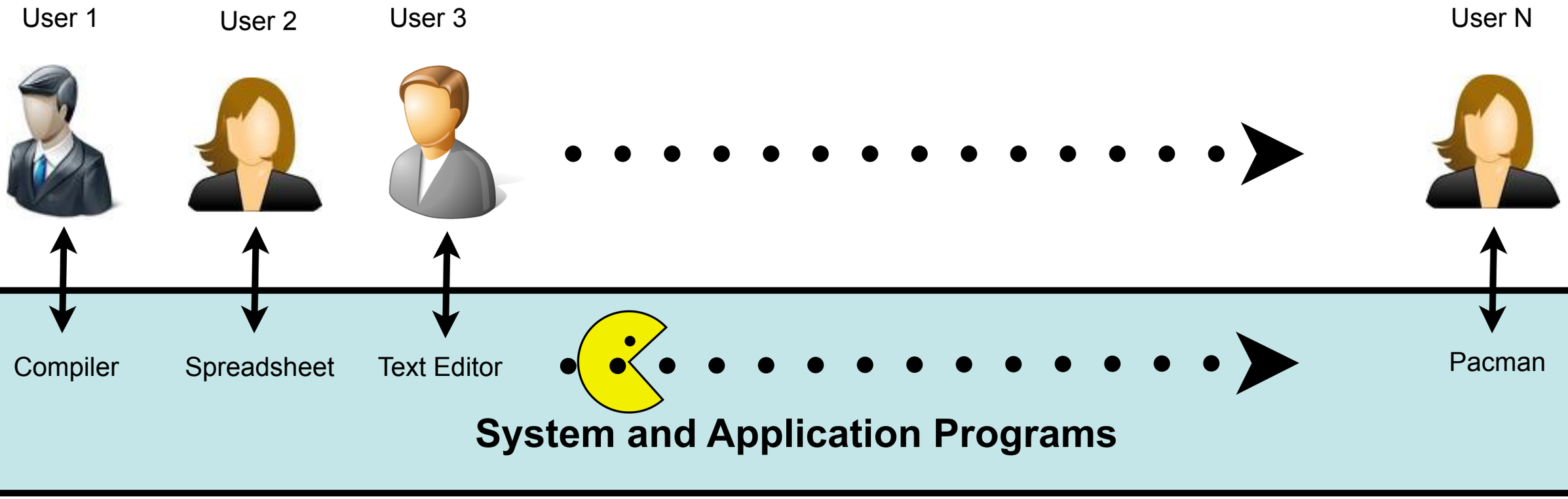
- All lectures given in English.
- Lecture slides in English.
- Karl (lecturer) is a native Swedish speaker so you may use either Swedish or English when interacting with him.
- Only one of the teaching assistans is a native Swedish speaker so english will be the main language for interacting with the teaching assistants.

Language for modules 8 & 9

- ★ All lectures in Swedish.
- ★ Lecture slides in both Swedish and English.
- ★ Karl (lecturer) is a native Swedish speaker so you may use either Swedish or English when interacting with him.
- ★ Only one of the teaching assistans is a native Swedish speaker so english will be the main language for interacting with the teaching assistants.

Operating Systems

- What is an operating system?
- Why is this interesting?
- Why should we learn about this?



Operating System

Controls the hardware and coordinates its use among the various application programs for the various users.

Computer Hardware

Learning about **operating systems** is both **useful** and **fun**

You leverage what you learned in other courses

- ★ Computer architecture
- ★ Assembly programming
- ★ C programming

System and Application Programs

Operating System

You will learn how an operating system provides an **environment for programs to execute** (on a single core CPU) seemingly *"at the same time"* sharing the CPU without the programs knowing about each other or knowing the details of the actual hardware.

Computer Hardware

After this course you will have a better understanding of what is happening *”under the hood”* and thereby **become** a much **better engineer** and/or **programmer**.

After completing this course you should have **enough knowledge** to **program** a small and **simple operating system** all by yourself if you put in some effort.

Grading

Results are reported to the student register (Uppdok) using a number of exam codes.

Some exam codes are graded with Fail/Pass and others with Fail, 3, 4 and 5.

The final grade for the course is computed as an weighted average of the exams codes graded with 3, 4 and 5.

OS (1DT044)

For the OS (1DT044) course the following exam codes are used to report results.

Exam code			Hp	Grading scale	Comment
Nr	**Name**	**Symbol**			
0300	Theory	T	1	Fail/Pass	
0400	Assignments	A	2	Fail, 3, 4, 5	This grade is calculated by rounding the average grade of the three programming assignments for module 1, 2 and 4.
0500	Written exam	E	1	Fail, 3, 4, 5	

The final grade (FG) is computed by rounding the weighted average of the assignments and final written exams.

$$FG = \left[\frac{2A + E}{3} \right]$$

OSPP (1DT006)

For the OS (1DT096) course the following exam codes are used to report results.

Exam code			Hp	Grading scale
Nr	**Name**	**Symbol**		
1000	Theory (part 1)	T_1	1	Fail/Pass
2000	Assignments (part 1)	A_1	2	Fail, 3, 4, 5
3000	Written exam (part 1)	E	1	Fail, 3, 4, 5
4000	Theory (part 2)	T_2	1	Fail/Pass
5000	Assignments (part 2)	A_2	1	Fail, 3, 4, 5
6000	Project (group)	P_g	2	Fail, 3, 4, 5
7000	Project (individual)	P_i	5	Fail, 3, 4, 5
0400	Project report	P_r	1	Fail/Pass

OSPP (1DT006)

The final grade (FG) is computed by rounding the weighted average of the assignments, project and final written exams.

$$FG = \left[\frac{2A_1 + E + A_2 + 5P_i + 2P_g}{11} \right]$$

Learning outcomes OS (1DT044)

After passing the course, the student should be able to:

1. explain how operating systems interact with various types of hardware and software
2. describe how the operating systems are structured internally, as well as explain the basic principles and theories for this
3. explain algorithms: scheduling, synchronisation, and memory allocation
4. solve simple programming tasks within eg synchronisation, file systems, and information protection.

Learning outcomes OSPP (1DT096)

Efter godkänd kurs ska studenten kunna:

1. redogöra för hur operativsystem och runtimesystem växelverkar med maskin- och programvara.
2. förklara och använda algoritmer och tekniker för schemaläggning och synkronisering i olika system
3. redogöra för hur synkroniseringstekniker kan användas för att hantera samtidighet i datorsystem, och bedöma deras lämplighet i olika situationer
4. redogöra för principerna för olika programmeringsmodeller av flerkärniga system, till exempel processer, trådar, meddelandeöverföring och “software transactional memory”, och konstruera program som använder dessa

Learning outcomes OSPP (1DT096)

Efter godkänd kurs ska studenten kunna:

5. använda verktyg för versionshantering, felsökning och testning
6. genomföra ett strukturerat projektarbete tillsammans med andra studenter samt, under processen, reflektera över och utveckla gruppens samarbete
7. planera ett projekt, inklusive användande av samarbetsverktyg, så att det kan genomföras inom givna ramar
8. presentera och diskutera kursens innehåll muntligt och skriftligt med för utbildningsnivån lämplig fördighet.
9. redogöra för minneshantering och filssytem (nämns i kursplanen under innehåll).

What are you really good at?

How did you become good at this?

We learn in different ways

As a rough estimate the following conclusions can be made regarding how much you remember after a learning activity.

20 % after **listening**

30 % after **reading**

70 % after **talking**

90 % after **doing**

This tells us that listening to lectures and reading the on your own may not be the most efficient way to learn ...

The cognitive domain

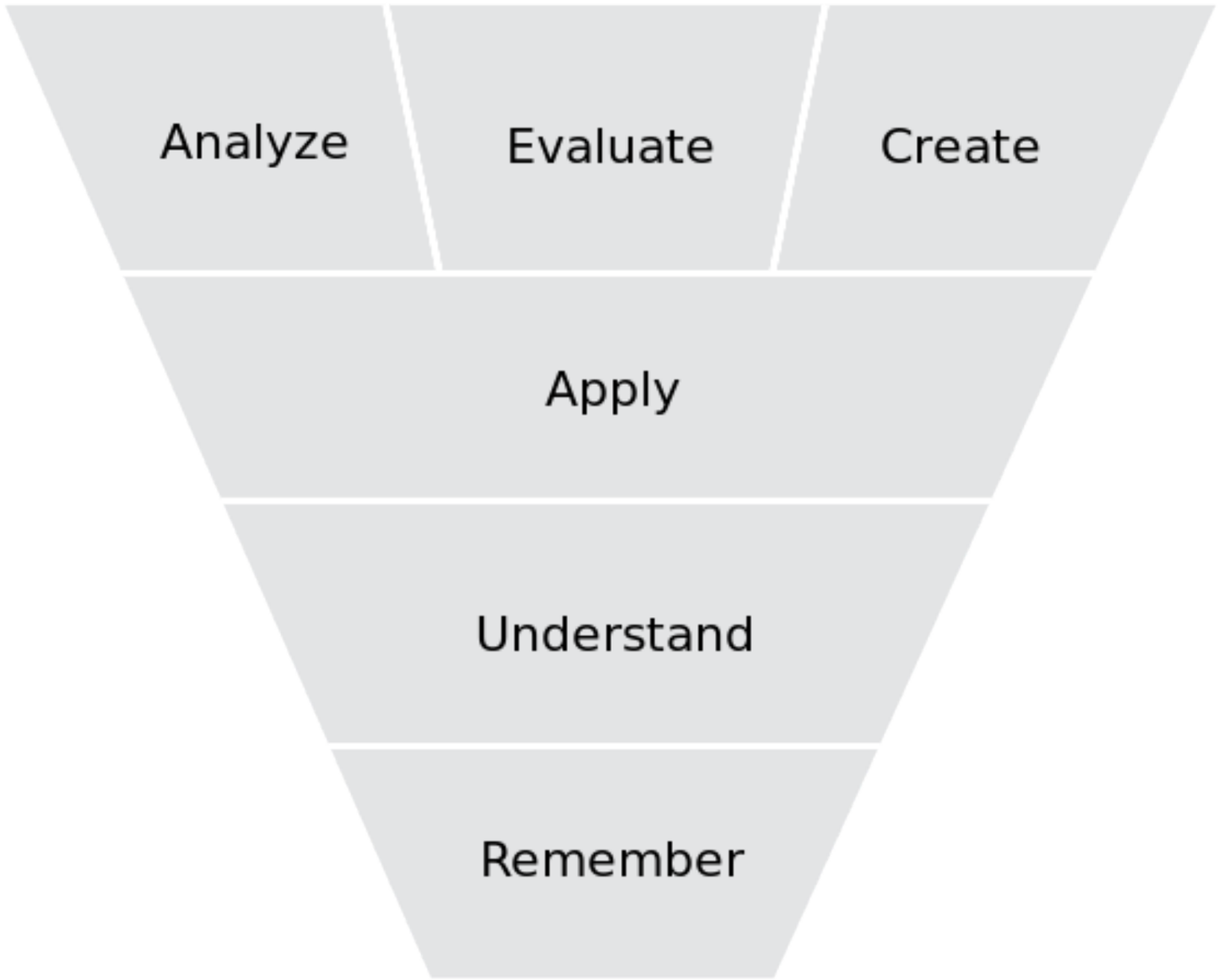


Image: http://commons.wikimedia.org/wiki/File:BloomsCognitiveDomain.svg 2016-01-17

Thinking and learning

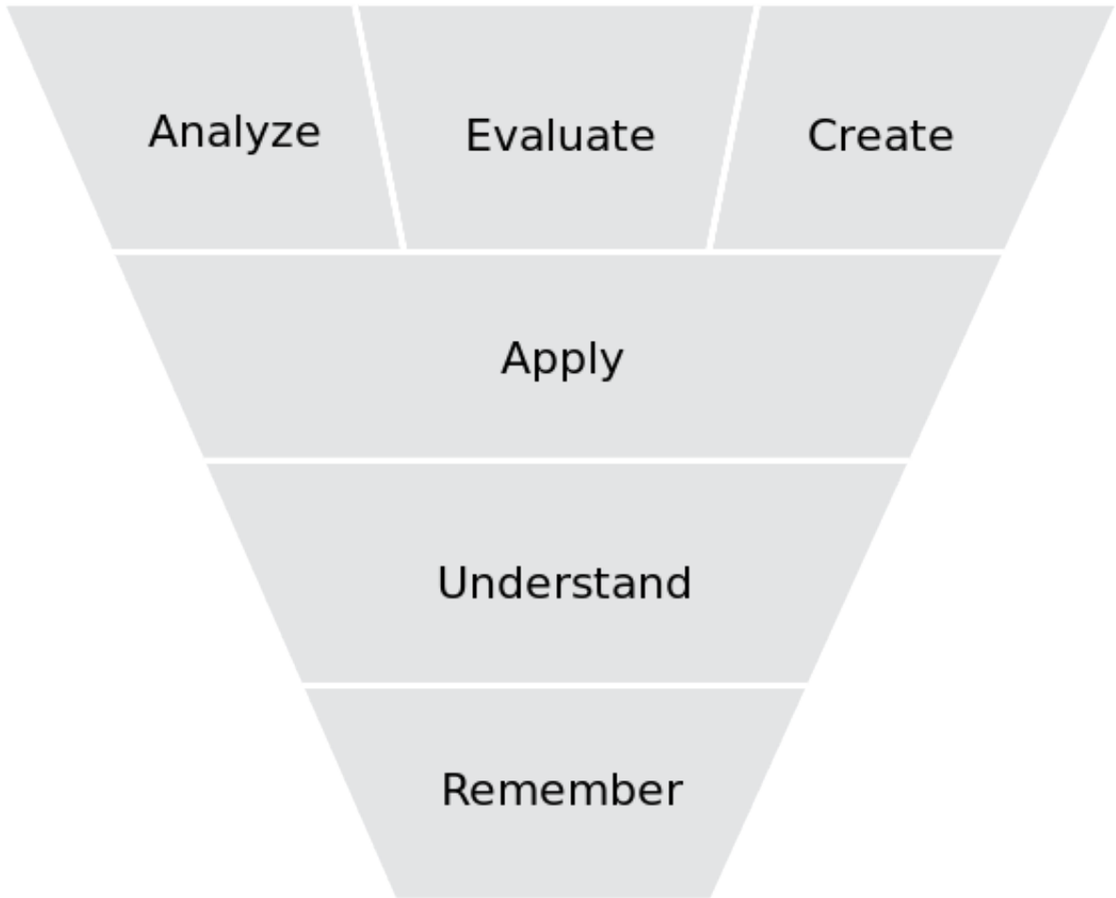
Seems like a good idea to combine these two models of learning and thinking.

20 % after **listening**

30 % after **reading**

70 % after **talking**

90 % after **doing**



Learning and examination activities

Teaching and examination is divided into four groups of activities: **learning**, **examination**, **higher grade** and **retake**.

- Participation in all **learning activities** is highly recommended but **not mandatory**.
- Participation is **mandatory** for all **examination** activities.
- To pass the course you **must pass all examination activities**.

Type	Abbreviation	Activity
Learning	L	Lecture
Learning	W	Workshop
Learning	T	Tutoring
Learning	Tx	Extra tutoring

Type	Abbreviation	Activity	Grading scale
Examination	S	Seminar	Fail/Pass
Examination	C	Code grading	Fail, 3
Higher grade	Ch	Higher grade code grading	Fail, 3, 4, 5
Examination	P	Presentation	Fail/Pass
Examination	E	Final written exam	Fail, 3, 4, 5

Type	Abbreviation	Activity	Grading scale
Retake	Sr	Retake seminar	Fail/Pass
Retake	Cr	Retake code grading	Fail, 3
Retake	Pr	Retake presentation	Fail/Pass
Retake	Er	Retake written exam	Fail, 3, 4, 5

More information about each activity can be found on the **course home page**.

Course pages in the Student portal

Operating Systems I, 5.0 c

Course code: 1DT044, Report code: 61203, 33%, DAG, NML, week: 03 - 11
Semester: Spring 2018

Operating Systems and Process-Oriented Programming, 15.0 c

Course code: 1DT096, Report code: 61236, 50%, DAG, NML, week: 03 - 22 Semester: Spring 2018

Course starting page

Syllabus with course literature

Library

LINKS

Course homepage

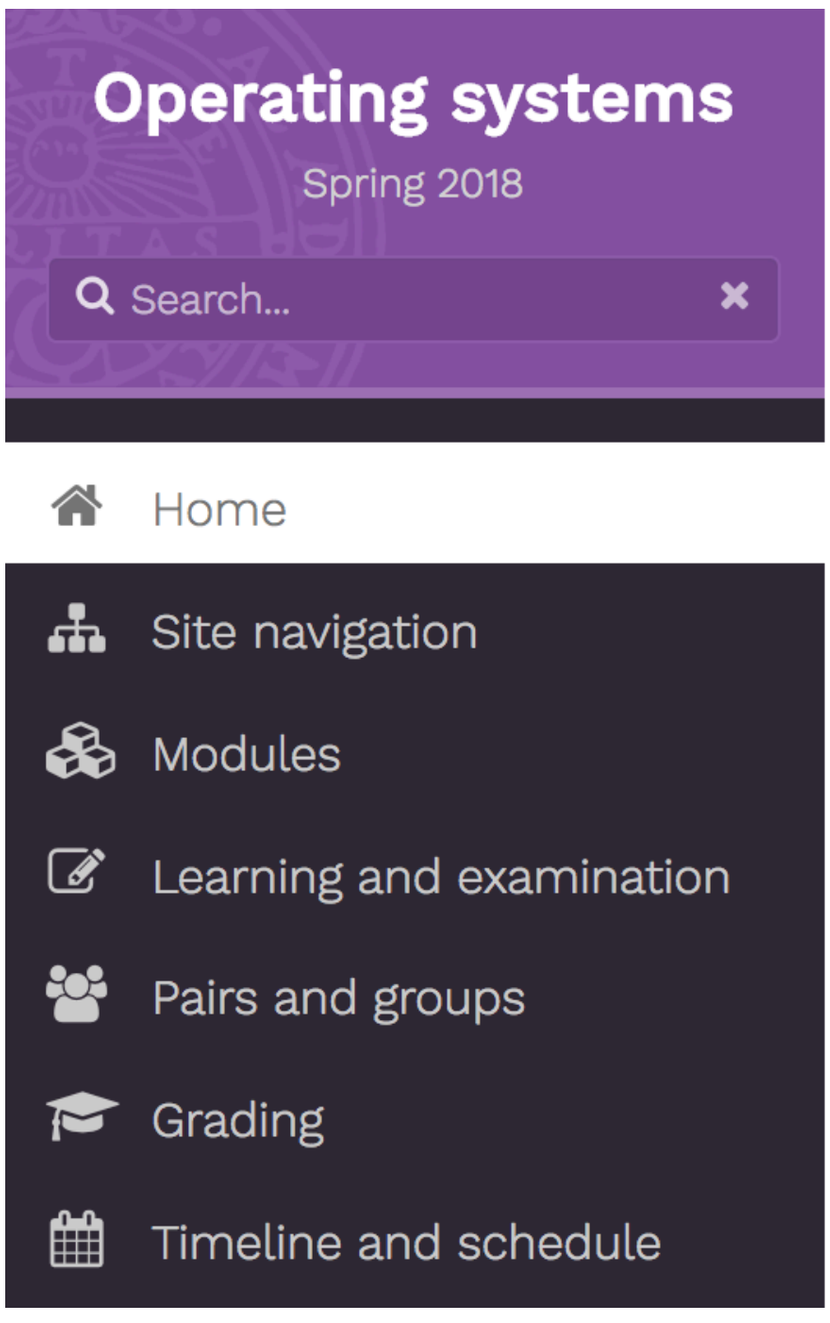
Web page

Link to **course home page**

www.it.uu.se/education/course/homepage/os/vt18

or

http://bit.ly/os-2018-homepage



Pairs and groups

During the course you will work in pairs (two students) and in groups of six students.

Pairs

For programming assignments you will work in pairs of two students. Two students can agree to create a pair or you can choose to be put in i a pool of students from which pairs will be created randomly.

Make your choice in the Student portal

Make your choose by visiting the Pairs section from the course page in the Student portal.

Pairs and groups

During the course you will work in pairs and in groups of six students.

Groups

Three random pairs will merge to form a six student group. This group will be used for workshops, seminars and presentations.

http://bit.ly/os-2018-timeline

Week	Day	Module						
		0	1	2	3	4	5	6
3	Mo	L + T						
	Tu		L					
	We		W					
	Th		T					
	Fr	T						
4	Mo		T					
	Tu		**S**					
	We	Tx		L				
	Th			W				
	Fr		**C**					
5	Mo			T (1DT096)				
	Tu		Tx	T (1DT044)				
	We		Sr					
	Th			T				
	Fr		Cr + Ch					

Module 0

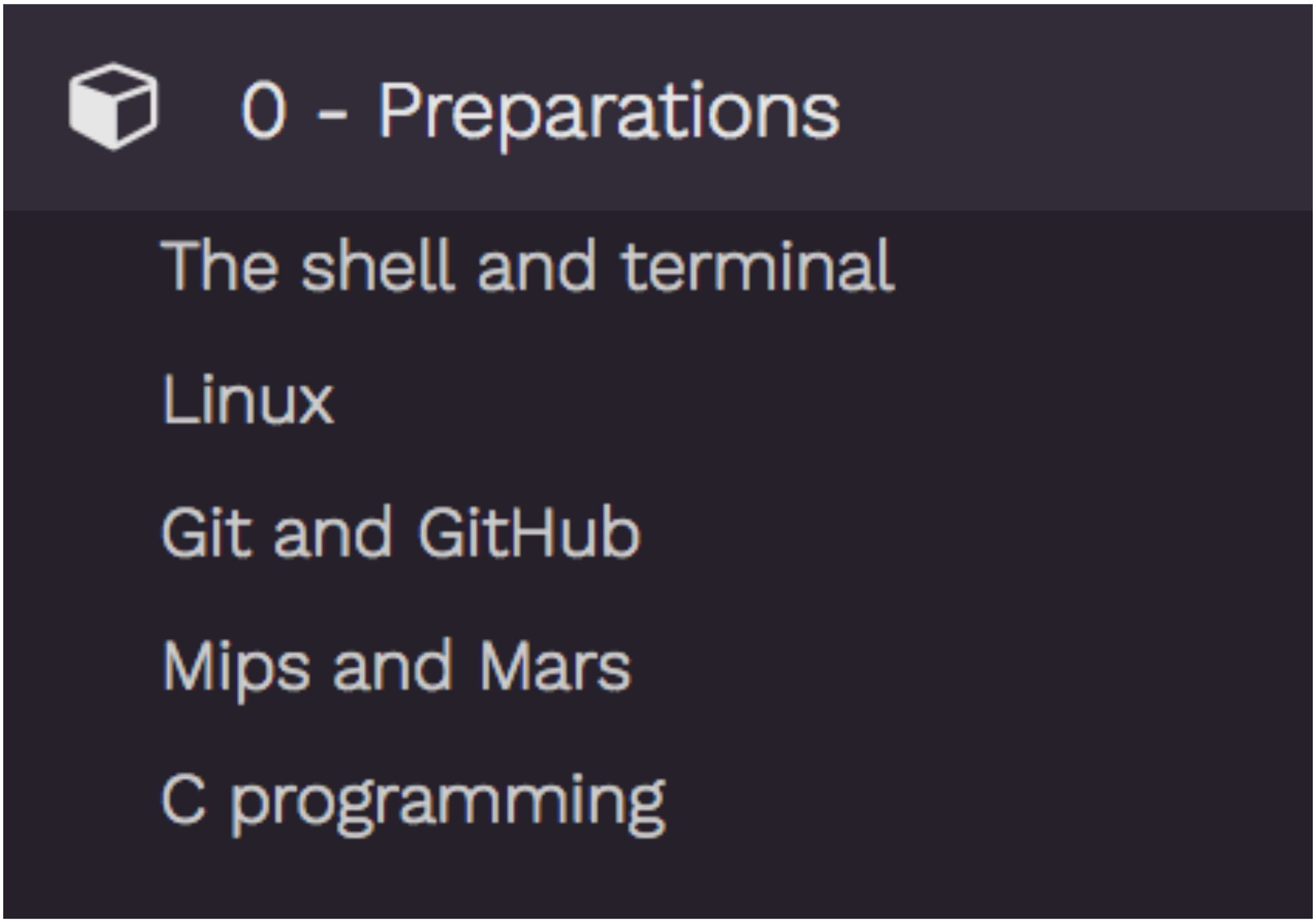
Course overview and preparations.




```
Run speed 20 inst/sec

        .data

msg:    .asciiz "Hello World!"

        .text

main:
        li $v0, 4
        la $a0, msg
        syscall

        li $v0, 1
        syscall
```

```c
#include <stdlib.h>
#include <stdio.h>

int main (void) {
  printf("Hello, World!\n");
  exit(0);
}
```

To prepare for the tutorials and programming assignments you should make sure to go through the material in this section.

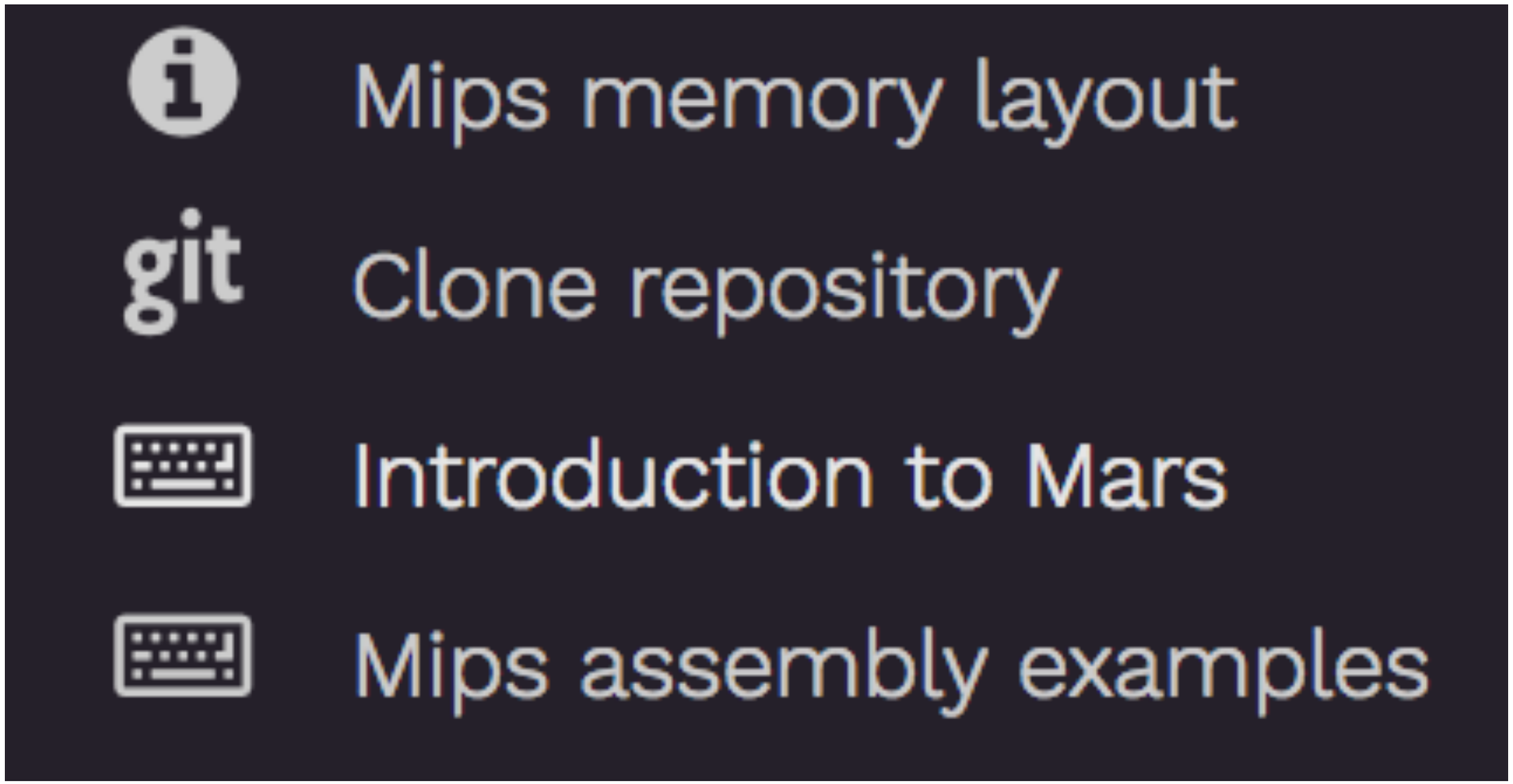

0 - Preparations
The shell and terminal
Linux
Git and GitHub
Mips and Mars
C programming

Mips and Mars

In order to study how the operating system interacts with the hardware, **Mips** assembly will be used.

To edit and execute Mips assembly programs we will use **Mars** (Mips Assembler and Runtime Simulator). Mars is available on the department Linux System.

Mars will run on any system (including Windows) as long as you have **Java installed**. If you prefer, you may **download** and install Mars on your private computer.


Mips memory layout
Clone repository
Introduction to Mars
Mips assembly examples

http://bit.ly/os-2018-timeline

Week	Day	Module 0	1	2	3	4	5	6
3	Mo	L + T						
	Tu		L					
	We		W					
	Th		T					
	Fr	T						
4	Mo		T					
	Tu		**S**					
	We	Tx		L				
	Th			W				
	Fr		**C**					
5	Mo			T (1DT096)				
	Tu		Tx	T (1DT044)				
	We		Sr					
	Th			T				
	Fr		Cr + Ch					

Mips and **Mars** will be used for the **module 1** programming assignment.

http://bit.ly/os-2018-timeline

Week	Day	Module 0	1	2	3	4	5	6
3	Mo	L + T						
	Tu		L					
	We		W					
	Th		T					
	Fr	T						
4	Mo		T					
	Tu		**S**					
	We	Tx		L				
	Th			W				
	Fr		**C**					
5	Mo			T (1DT096)				
	Tu		Tx	T (1DT044)				
	We		Sr					
	Th			T				
	Fr		Cr + Ch					

C will be used for the **module 2** and **module 4** programming assignment.

www.studentportalen.uu.se

HOW DO I REGISTER?

Information about when, where and how the student is to register is found on the course page in Student Portal.

As a new student, you must:

1. **Activate your student account**
2. **Log in to the Student Portal**
   Here you see information on what courses you are admitted to and how to register.
3. **Register for your course**
   If you do not register, you may lose your place!

Tip! Information concerning how to register can be found by searching for the name or application code for the course via **Search** in the Student Portal.

Are you registered?

Admitted students

Admitted students, including those who are admitted with a condition, must **web-register** themselves for the course in the Student Portal.

Students who are unable to web-register, should contact the Student Office (IT-kansliet): **it-kansli@it.uu.se**

Students will be able to **web-register until January 25 at the latest**.

The student counsellors will handle all conditions in the students' admissions.

Non Admitted students

Non admitted students should contact the StudentOffice (IT-kansliet) as soon as possible: **it-kansli@it.uu.se**

Exceptions:

- **Master students** should contact their programme counsellor (Liselott Dominicus): **studievagledare@it.uu.se**.
- **Exchange students** should contact Ulrika Jaresund, who is the exchange student coordinator at the IT Dept: **ulrika.jaresund@it.uu.se**.
- **Students with an older registration**, who want to re-register, should contact the Student Office (IT-kansliet): **it-kansli@it.uu.se**. You can only re-register if the course is not full.
- **Students who are placed on the waiting-list**, should wait for a possible answer (if any) via e-mail from the Student Office (IT-kansliet).

You are not able to take the exam, nor have any other results reported to Uppdok if you aren't admitted and registered for the course.

Sign up for final written exam

- You must sign up for the final written exam in the Student Portal.

- The exam signing-up system will not open until 2 weeks after the course start.

- The exam signing-up system in the Student Portal closes 12 days before the exam date.

Drop the course?

- Students who quit a course, must inform the Student Office (IT-Kansliet): it-kansli@it.uu.se

- If less than 3 weeks have passed since the course started, the course registration will be removed.

- After 3 weeks a "course intermission" will be reported to UPPDOK instead.

The Student Office (IT-kansliet): ITC building 4, floor 2, room 4204, **it-kansli@it.uu.se**.

Exchange student coordinator: Ulrika Jaresund, ITC building 4, floor 2, room 4215, **it-kansli@it.uu.se**.