

# Ubuntu tutorial

Parts of this tutorial has been adapted from M. Stonebank's *UNIX Tutorial for Beginners* (<http://www.ee.surrey.ac.uk/Teaching/Unix/>).

## 1 Installing Ubuntu

### About Ubuntu

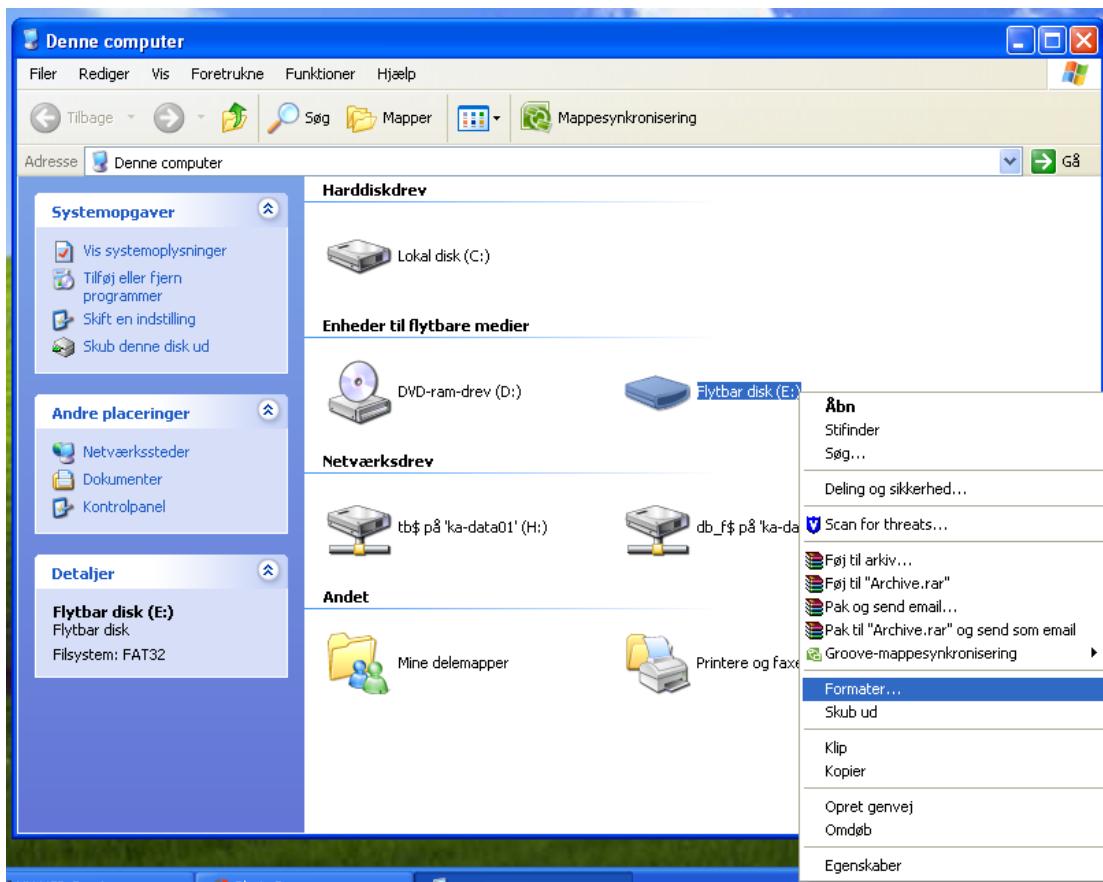
For our lab sessions we are going to use the operating system Ubuntu. Ubuntu is an operating system, just like Windows XP, Windows Vista, Windows 7, and Mac OS X are operating systems. The main difference between Ubuntu and these other operating systems is that it is free and open-source. Open-source means that it has been created by a collective of thousands of volunteers and that the source code is freely available and constantly being improved upon and examined for bugs.

The reason we will use Ubuntu instead of Windows is that much of the scientific software used for the applications described in our course, has been developed on Linux-based operating systems such as Ubuntu. In addition, Ubuntu is one of the most user-friendly Linux-based operating systems around, making it the optimal choice for our lab sessions. Note that it should theoretically be possible to run most of the software we are going to use under Windows, but this would require a lot of tinkering to get it to work. You are most welcome to try if you know your way around a computer, but we will not provide any support for running the software on Windows.

Another great thing about Ubuntu is that it is possible to install it on a USB flash drive and then start up from that flash drive. That means that we do not have to install an entirely new operating system on a computer, but we can instead carry around Ubuntu in our pocket, running it on almost any Windows machine you come across. After you have used Ubuntu, you can simply restart your machine, take out the USB key and start up your original Windows again, without any problems.

### Installing Ubuntu on a USB flash drive

What we're about to do will **erase all the data** on your USB flash drive, so make sure you have backed up any important information you might have saved on it! The first step will be to format the 4+GB USB flash drive. Go into the *Windows Explorer* or *This Computer*, right-click on the USB drive's icon, and select *Format*.



*Formatting a USB drive*

Usually the default settings are fine the way they are; just make sure you format it as **FAT32**.



*Format settings*

Then click start and wait for the formatting process to finish. Now we are almost ready to put Ubuntu on it. First, we need to download two files. Start by downloading the 32-bit Desktop Edition of Ubuntu (Lucid Lynx LTS 10.04.1, PC

**(Intel x86) desktop CD**) from <http://releases.ubuntu.com/lucid/>. This is a large download (~900MB). Then download **Linux USB Live Creator** from <http://www.linuxliveusb.com/>. What you've just downloaded is a self-extracting archive. Run it and it will ask you for a location to extract the actual program to. Pick the Desktop ('Skrivebord'). Then run the program inside the new folder that was created on your desktop. If you are not sitting in the OpenLab, you will need special login credentials to be allowed to run the program. Ask us about this and use it to execute the program. Wait until the Ubuntu download is done before you continue. Now we're ready to put Ubuntu on the USB stick. Fire up **Linux USB Live Creator**, which should look like this:



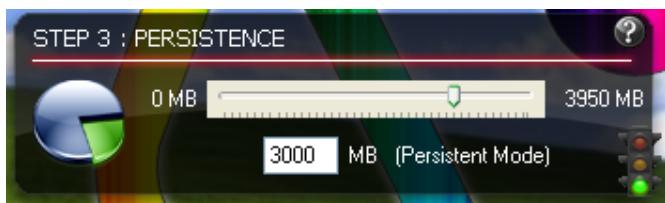
*Linux Live USB Creator at start-up*

Select your USB stick from the dropdown list in step 1. In step 2, click on **ISO/IMG/ZIP** and select the Ubuntu ISO image file you just downloaded. The program will then start checking the ISO image and when it's done it should look like:



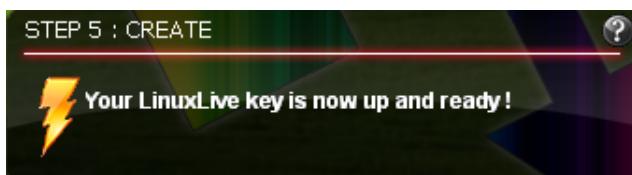
*Step 2: Selecting and checking the ISO image*

Because we would like to save our changes every time we restart Ubuntu, we are going to make the installation on the USB stick *persistent*. Step 3 is where we tell the program how much space we would like to have to save files in, install programs, etc. Because of technical details<sup>1</sup>, the maximum size is 4 GB. Somewhere between 3 and 4 GB will be fine. In the example below, it's been set to 3 GB. Be warned, the larger the you make the file, the longer the final installation will take.



*Step 3: Specifying the size of the persistence file*

The default settings for step 4 tend to be fine, so skip to step 5 and click on the lightning bolt to start installing Ubuntu on your USB stick! This will take at least 15-20 minutes.



*Step 5, when everything has gone right!*

When it's done, we're going to reboot the machine and start up Ubuntu. Do not eject the USB flash drive and keep it in the USB slot. We now need to tell the PC right after we restart it that it needs to boot from the USB flash drive (Ubuntu) instead of from the hard disk (Windows). We do this by entering the **Boot Menu**, and this is usually done by pressing one of the function keys right when the computer is starting up (so *before* you see any sign of Windows being started!) At RSLIS, you usually have to press F9 to enter the **Boot Menu**, but it might be a different function key on different machine (such as F12 or F2). Your computer will always show on the screen which key you need to press, but you will need to be fast. Usually you will only have 3-5 seconds to press it.

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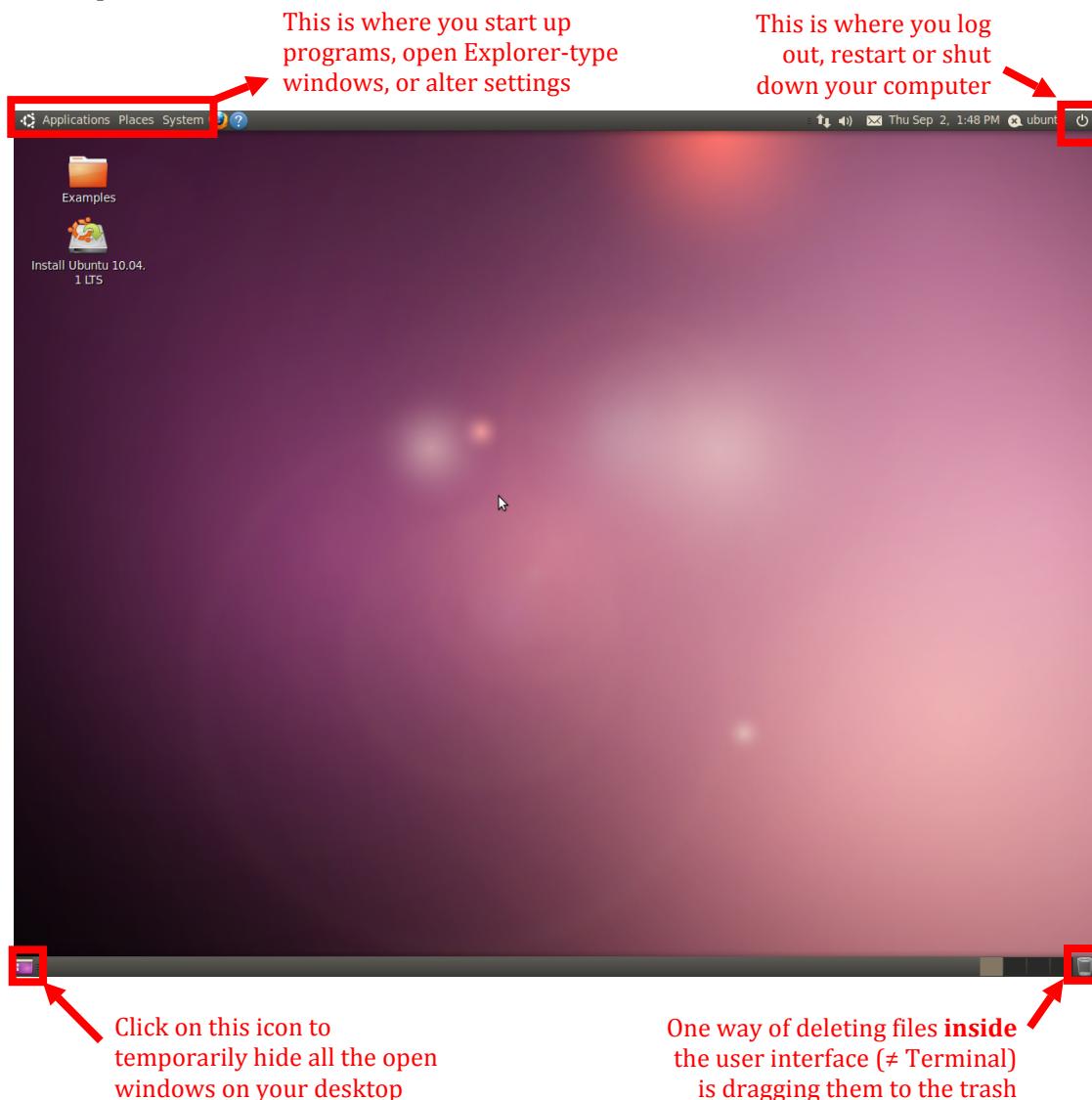
<sup>1</sup> The largest file size FAT32 will allow is 4GB.

Restart the PC and enter the boot menu. Select booting from USB stick and wait as Ubuntu is started up. This might take a few minutes. When you're asked for another choice between (among other things) **Persistent Mode**, **Live Mode**, and **Install**. Select the top option (**Persistent Mode**). Never select **Install** or Ubuntu will start installing itself permanently on your machine, overwriting the current Windows installation! Nothing scary will happen to your machine if you choose **Live Mode**; any changes you make in Ubuntu will just not be saved.

Congratulations! If all went well, then you've just started Ubuntu for the first time!

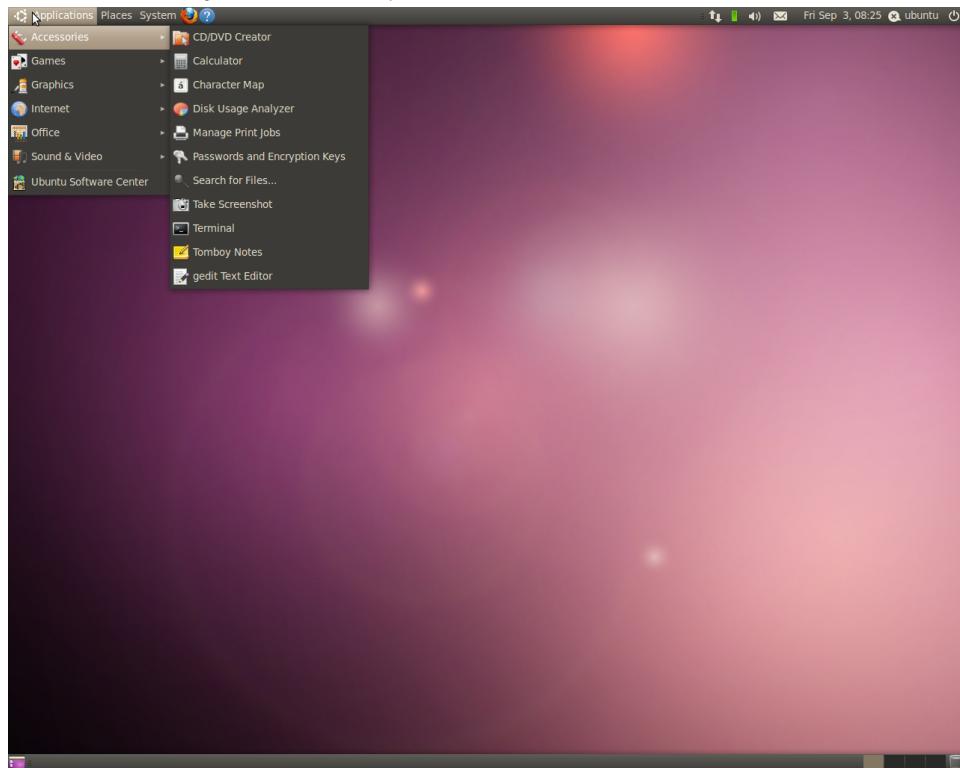
## 2 Exploring Ubuntu

Below you see a picture of what your desktop will look like the first time you start up Ubuntu.



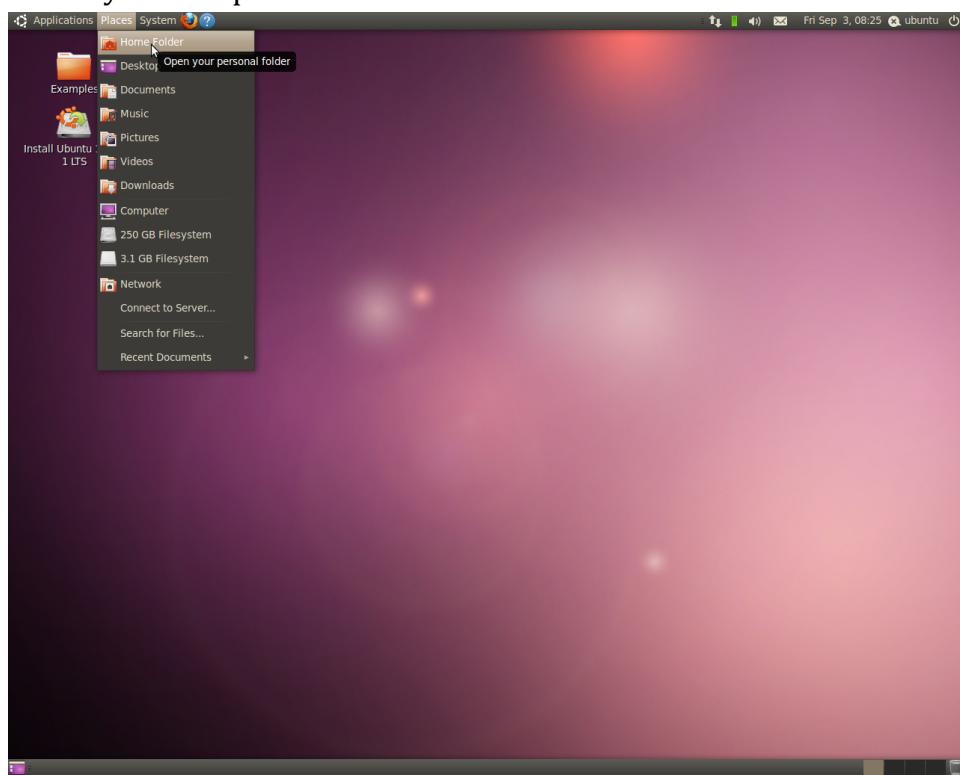
Let's look at the three menus at the top right: **Applications**, **Places**, and **System**. **Applications** is where you can find many of the applications in Ubuntu (at least

the ones with a GUI!). This works just like the **Start** menu in Windows.



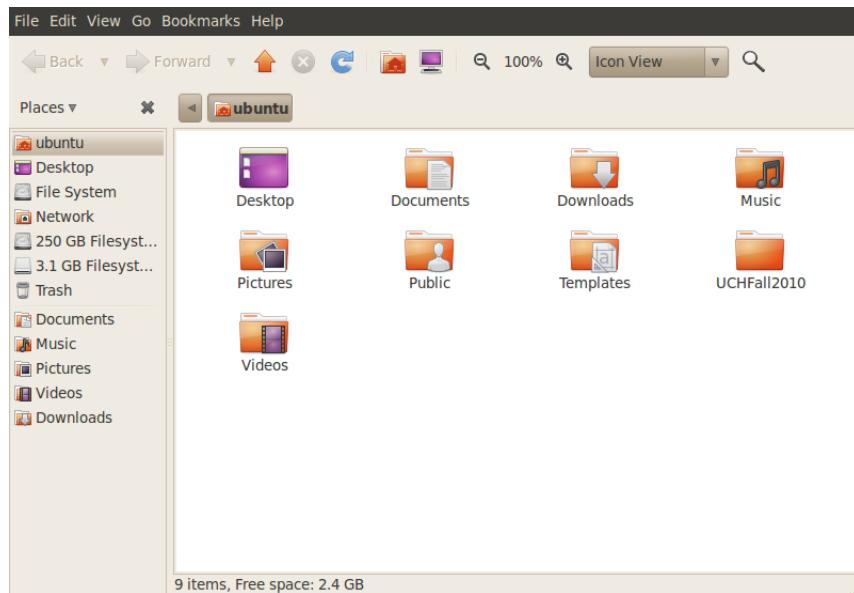
*The Applications menu in Ubuntu*

Under *Applications > Accessories* you can find some useful applications, such as the standard text editor **gedit Text Editor** for instance, the Ubuntu equivalent of Windows' **Notepad**. The **Places** menu lists different common or important locations on your computer.



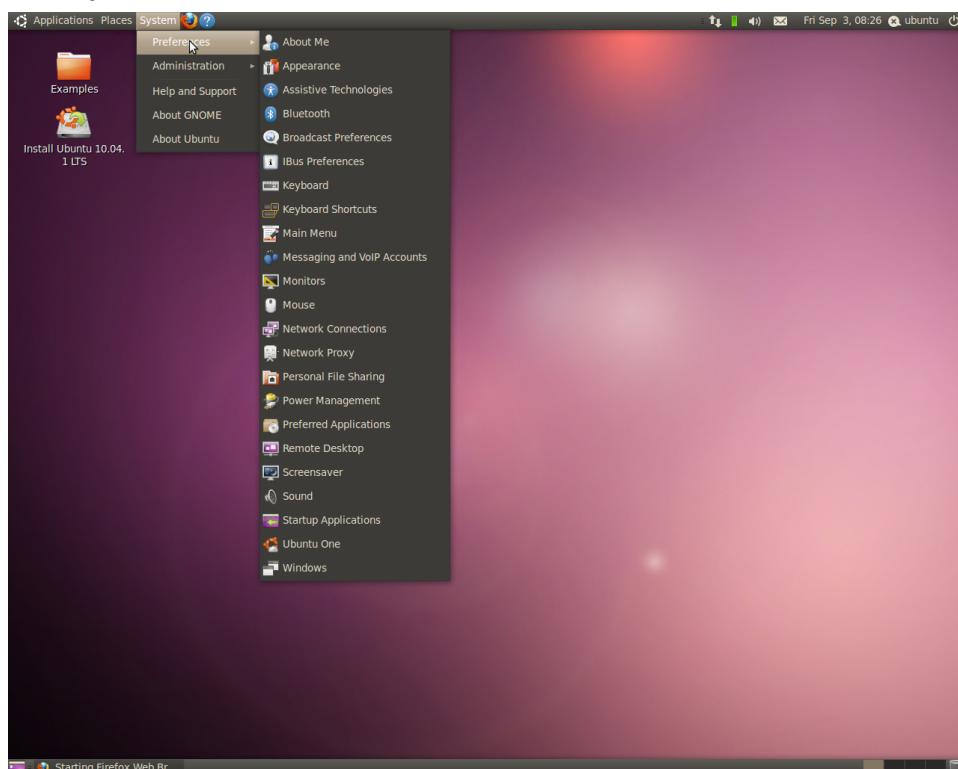
*The Places menu in Ubuntu*

If you select your *Places > Home Folder*, you open a file explorer window of your home directory. Your home directory is where your personal files and subdirectories are saved. The window should look something like this (minus the **UCHFall2010** folder, which we'll create later)



*Your home folder in Ubuntu*

The third menu that is interesting is the **System** menu. This is where you can alter many of Ubuntu's settings, such as user accounts, desktop backgrounds, keyboard layouts, install new software, etc.

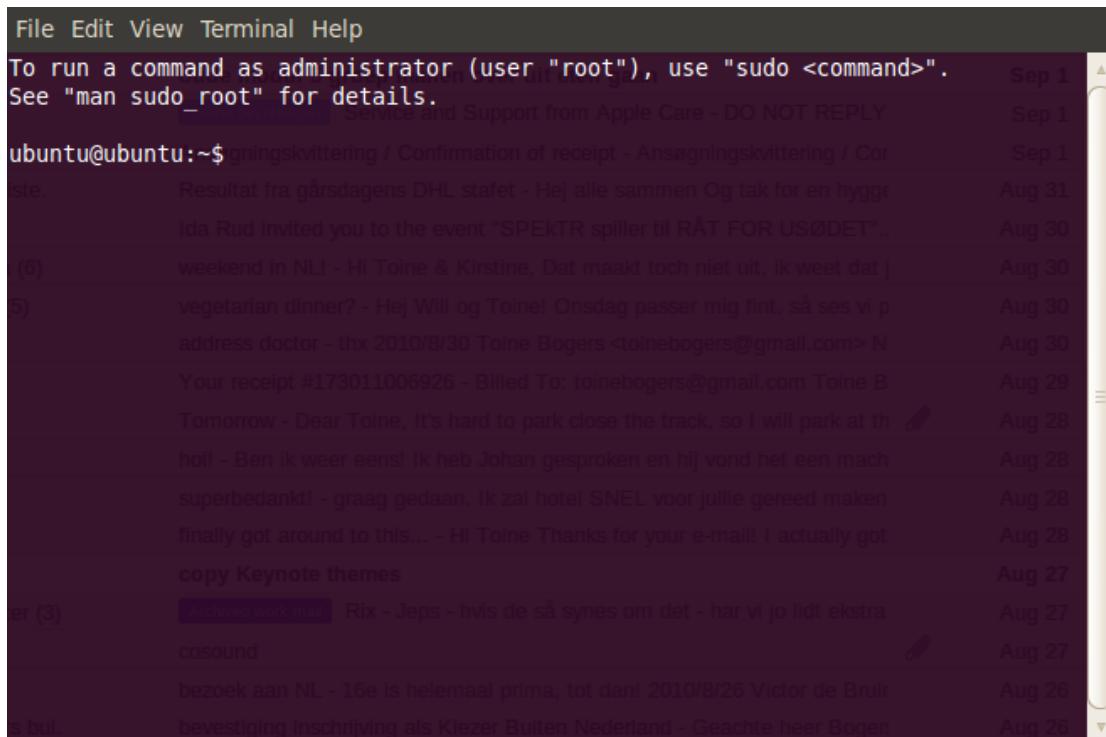


*The System menu in Ubuntu*

Try it out by updating the time by going to *System > Administration > Time and Date*.

You can create shortcuts to each of the items in these three menus on, for instance, your desktop. Just drag an icon to the desktop. Try dragging the Firefox browser icon to your desktop. If all went well, you now have a link to Firefox on your desktop as well. Try playing around with Ubuntu a bit to get a feel for how things work.

When you're ready, we're going to dig a little deeper into Ubuntu. Go to *Applications > Accessories* and start up a **Terminal**. This should look like this



The terminal window shows a command-line interface with a dark background. At the top, there's a menu bar with options: File, Edit, View, Terminal, Help. Below the menu, the terminal prompt is visible: `ubuntu@ubuntu:~$`. The background of the terminal window is semi-transparent, allowing a list of emails from the Mail application to be seen. The emails are listed in a standard email client format with subject lines, senders, and dates.

Subject	From	Date
To run a command as administrator (user "root"), use "sudo <command>".		Sep 1
See "man sudo_root" for details.		Sep 1
Service and Support from Apple Care - DO NOT REPLY		Sep 1
ubuntu@ubuntu:~\$ mngskvittering / Confirmation of receipt - Ansøgningskvittering / Cor		Sep 1
ste. Resultat fra gårsdagens DHL stafet - Hej alle sammen Og tak for en hygge		Aug 31
(6) Ida Rud invited you to the event "SPEkTR spiller til RÅT FOR USØDET" ..		Aug 30
5) weekend in NL! - Hi Toine & Kirstine, Dat maakt toch niet uit, ik weet dat j		Aug 30
vegetarian dinner? - Hej Will og Toinel Onsdag passer mig fint, så ses vi p		Aug 30
address doctor - thx 2010/8/30 Toine Bogers <toinebogers@gmail.com> N		Aug 30
Your receipt #173011006926 - Billed To: toinebogers@gmail.com Toine B		Aug 29
Tomorrow - Dear Toine, It's hard to park close the track, so I will park at th		Aug 28
hoi! - Ben ik weer eens! Ik heb Johan gesproken en hij vond het een mach		Aug 28
superbedankt! - graag gedaan. Ik zal hotel SNEL voor jullie gereed maken		Aug 28
finally got around to this... - Hi Toine Thanks for your e-mail! I actually got		Aug 28
copy Keynote themes		Aug 27
er (3) Archived work mail Rix - Jeps - hvis de så synes om det - har vi jo lidt ekstra		Aug 27
cosound		Aug 27
bezoek aan NL - 16e is helemaal prima, tot dan! 2010/8/26 Victor de Bruir		Aug 26
bevestiging Inschrijving als Klezer Bulten Nederland - Geachte heer Bogen		Aug 26

*Terminal - A freshly opened Terminal window*

The **Terminal** is similar to the **Command Prompt** in Windows. It's a command-line interface to the system. This means that you can get direct access to all the functionality by typing in commands. In some cases, using a GUI is superior, but for other tasks being able to directly execute multiple tasks with a single line of commands can save you lots of time. It depends on the task your performing whether one or the other is the best choice. In the rest of this tutorial you'll learn to use the command line for small tasks.

### 3 Listing files and directories

#### ls (list)

When you first open a Terminal window, your current working directory is (nearly) always your home directory. As mentioned before, your home directory is where your personal files and subdirectories are saved. Your home directory

normally has the same name as your user-name; in our case it will always be **ubuntu**, since we're booting a special version of Ubuntu directly from the USB stick.

To find out what is in your home directory, type

```
ls
```

NOTE: every command/line in these black/yellow boxes needs to be followed by a [Return]

The **ls** command (lowercase L and lowercase S) lists the contents of your current working directory.

A screenshot of a terminal window titled "Terminal - running the ls command". The window shows the command "ls" being run at the prompt "ubuntu@ubuntu:~\$". The output lists several files and folders in the current directory, including "Desktop", "Documents", "Downloads", "Music", "Pictures", "Public", "Templates", and "Videos". Below these, there are numerous email messages in the inbox, each with a subject line and a timestamp. The terminal window has a dark background with light-colored text.

```
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>". See "man sudo_root" for details.
ubuntu@ubuntu:~$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
ubuntu@ubuntu:~$
```

(6) weekend in NL! - Hi Toine & Kirstine, Dat maakt toch niet uit, ik weet dat j Aug 30
(5) vegetarian dinner? - Hej Will og Toine! Onsdag passer mig fint, så ses vi p Aug 30
address doctor - thx 2010/8/30 Toine Bogers <toinebogers@gmail.com> N Aug 30
Your receipt #173011006926 - Billed To: toinebogers@gmail.com Toine B Aug 29
Tomorrow - Dear Toine, It's hard to park close the track, so I will park at th Aug 28
hol! - Ben ik weer eens! Ik heb Johan gesproken en hij vond het een mach Aug 28
superbedankt! - graag gedaan. IK zal hotel SNEL voor jullie gereed maken Aug 28
finally got around to this... - Hi Toine Thanks for your e-mail! I actually got Aug 28
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bevestiging inschrijving als Klezer Buitenhuis Nederland - Geachte heer Boose Aug 26

Terminal - running the **ls** command

There may be no files visible in your home directory, in which case, the UNIX prompt will be returned. Alternatively, there may already be some files inserted by the System Administrator when your account was created.

**ls** does not, in fact, cause all the files in your home directory to be listed, but only those ones whose name does not begin with a dot (**.**) Files beginning with a dot (**.**) are known as hidden files and usually contain important program configuration information. They are hidden because you should not change them unless you are very familiar with Ubuntu and Linux.

To list all files in your home directory including those whose names begin with a dot, type

```
ls -a
```

As you can see, `ls -a` lists files that are normally hidden.

```
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
ubuntu@ubuntu:~$ ls -a
Desktop Documents Downloads Music Pictures Public Templates Videos
ubuntu@ubuntu:~$ ls -a
. .dbus .gtk-bookmarks .pulse-cookie Music
.. .esd_auth .gvfs .recently-used.xbel Pictures
.ICEauthority .fontconfig .local .update-notifier Public
.bash_logout .gconf .mozilla .xsessions-errors Templates
.bashrc .gconfd .nautilus Desktop Videos
.cache .gnome2+17301100692.profile Documents Toine B
.config .gnome2_private its.pulse Downloads
ubuntu@ubuntu:~$
```

*Terminal - running the `ls -a` command*

`ls` is an example of a command which can take options: `-a` is an example of an option. The options change the behavior of the command. There are manual pages that tell you which options a particular command can take, and how each option modifies the behavior of the command. We'll get to this later in this tutorial.

## 4 Making directories

### [mkdir \(make directory\)](#)

We will now make a subdirectory in your home directory to hold the files you will be creating and using in the course of this tutorial. To make a subdirectory called `UCHFall2010` in your current working directory type

```
mkdir UCHFall2010
```

You are more than welcome to choose a different name for this directory, but this is the name we'll be using in the rest of this tutorial and in all other tutorials. To see the directory you have just created, type

```
ls
```

## 5 Changing to a different directory

`cd` (change directory)

The command `cd` directory means change the current working directory to 'directory'. The current working directory may be thought of as the directory you are in, i.e. your current position in the file-system tree.

To change to the directory you have just made, type

```
cd UCHFall2010
```

Type `ls` to see the contents (which should be empty)

### Exercise 1

Make another directory inside the `UCHFall2010` directory called `backups`

## 6 The directories . and ..

Still in the `UCHFall2010` directory, type

```
ls -a
```

As you can see, in the `UCHFall2010` directory (and in all other directories), there are two special directories called `(.)` and `(..)`

### The current directory (.)

In UNIX, `(.)` means the current directory, so typing

```
cd .
```

NOTE: there is a space between `cd` and the dot

means stay where you are (the `UCHFall2010` directory).

This may not seem very useful at first, but using `(.)` as the name of the current directory will save a lot of typing, as we shall see later in the tutorial.

### The parent directory (..)

`(..)` means the parent of the current directory, so typing

```
cd ..
```

will take you one directory up the hierarchy (back to your home directory). Try it now.

Note: typing `cd` with no argument always returns you to your home directory. This is very useful if you are lost in the file system!

## 7 Pathnames

### pwd (print working directory)

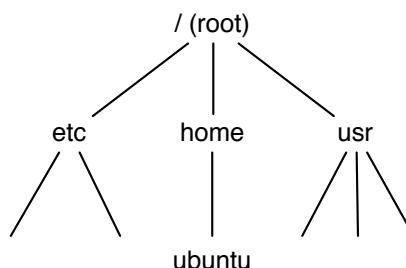
Pathnames enable you to work out where you are in relation to the whole file-system. For example, to find out the absolute pathname of your home-directory, type `cd` to get back to your home-directory and then type

```
pwd
```

The full pathname will look something like this

```
/home/ubuntu
```

which means that `ubuntu` (your home directory) is in the `home` sub-directory, which is in the top-level root directory called "`/`". Below is a visualization of the directory tree structure and the location of your home directory.



*Small part of the tree structure of the underlying directories*

Use the commands `cd`, `ls` and `pwd` to explore the file system. Remember, if you get lost, type `cd` by itself to return to your home-directory.

## 8 More about home directories and pathnames

### Understanding pathnames

First type `cd` to get back to your home-directory, then type

```
ls UCHFall2010
```

to list the contents of your `UCHFall2010` directory.

Now type

```
ls backups
```

You will get a message like this

```
ls: cannot access backups: No such file or directory
```

The reason is, `backups` is not in your current working directory. To use a command on a file (or directory) not in the current working directory (the directory you are currently in), you must either `cd` to the correct directory, or specify its full pathname. To list the contents of your `backups` directory, you must type

```
ls UCHFall2010/backups
```

### ~ (your home directory)

Home directories can also be referred to by the tilde `~` character. It can be used to specify paths starting at your home directory. So typing

```
ls ~/UCHFall2010
```

will list the contents of your `UCHFall2010` directory, no matter where you currently are in the file system.

### Exercise 2

What do you think

```
ls ~
```

would list?

What do you think

```
ls ~/..
```

would list?

## 9 Copying Files

### cp (copy)

`cp file1 file2` is the command, which makes a copy of `file1` in the current working directory and calls it `file2`.

What we are going to do now, is to take a file that we download and save in the `Downloads` directory, and use the `cp` command to copy it to your `UCHFall2010` directory. Open Firefox (if it isn't still open in the background) and go to this URL: <http://www.ee.surrey.ac.uk/Teaching/Unix/science.txt>. In Firefox select 'Save Page As' and save it in the `Downloads` directory. This should be the default directory Firefox offers to save it in.

Now we're ready to copy this file to another location. First, `cd` to the `UCHFall2010` directory.

```
cd ~/UCHFall2010
```

Then at the UNIX prompt, type,

```
cp ~/Downloads/science.txt .
```

Note: Don't forget the dot `.` at the end. Remember, in UNIX, the dot means the current directory.

The above command means copy the file `science.txt` from the `Downloads` directory to the current directory, keeping the name the same.

### Exercise 3

Create a backup of your `science.txt` file by copying it to a file called `science.bak`.

## 10 Moving files

### mv (move)

`mv file1 file2` moves (or renames) `file1` to `file2`.

To move a file from one place to another, use the `mv` command. This has the effect of moving rather than copying the file, so you end up with only one file rather than two.

It can also be used to rename a file, by moving the file to the same directory, but giving it a different name.

We are now going to move the file `science.bak` to your `backups` directory.

Make sure you are inside your `UCHFall2010` directory, then type

```
mv science.bak backups/
```

Now type `ls` and `ls backups` to see if it has worked.

## 11 Removing files and directories

### `rm (remove)`, `rmdir (remove directory)`

To delete (remove) a file, use the `rm` command. The result of this is **permanent!** It is not possible to undelete files or directory, so make sure you know what you are doing! As an example, we are going to create a copy of the `science.txt` file, then delete it.

Inside your `UCHFall2010` directory, type

```
cp science.txt tempfile.txt
ls
rm tempfile.txt
ls
```

You can use the `rmdir` command to remove a directory (make sure it is empty first). Try to remove the `backups` directory. You will not be able to since UNIX will not let you remove a non-empty directory.

### Exercise 2b

Create a directory called `tempstuff` using `mkdir`, then remove it using the `rmdir` command.

## 11 Displaying the contents of a file on the screen

### `clear (clear screen)`

Before you start the next section, you may like to clear the terminal window of the previous commands so the output of the following commands can be clearly understood.

At the prompt, type

```
clear
```

This will clear all text and leave you with the `ubuntu@ubuntu:~$` prompt at the top of the window.

### cat (concatenate)

The command `cat` can be used to display the contents of a file on the screen. Type:

```
cat science.txt
```

As you can see, the file is longer than the size of the window, so it scrolls past making it unreadable.

### less

The command `less` writes the contents of a file onto the screen a page at a time. Type

```
less science.txt
```

Press the [space-bar] if you want to see another page, or use [Page Up] and [Page Down] to move through the document. Type [q] if you want to quit reading. As you can see, `less` is used in preference to `cat` for long files.

### head

The `head` command writes the first ten lines of a file to the screen.

First clear the screen then type

```
head science.txt
```

Then type

```
head -5 science.txt
```

What difference did the `-5` do to the `head` command?

## tail

The `tail` command writes the last ten lines of a file to the screen.

Clear the screen and type

```
tail science.txt
```

### Exercise 4

How can you view the last 15 lines of the file?

## 12 Tab completion & command history

Ubuntu (as well as all other Linux-based operating systems, including Mac OS X) offer a great feature called tab completion, which can save you a lot of time. Whenever you're typing the names of files, directories, or commands in the Terminal, you can make it help you auto-complete the name by pressing the [Tab] key. For instance , type

```
tail sc
```

and then press the [Tab] key. Ubuntu will automatically complete the filename to `science.txt` by looking in the directory you're in (as well as some shared ones) for files, commands, or directories whose name starts with `sc`. If there is only one unambiguous choice, it will select that one. If there are multiple options, it will not auto-complete. You can make it show you a list of all files that start with the characters you have entered so far by pressing [Tab] once more. Type

```
cp science.txt scientific.txt  
tail sc
```

and press [Tab] after you've typed `sc`. Now there are two files in the directory that start with `sc`, so tab completion cannot choose for you. It will however complete it as far as it can:

```
tail scienc
```

If you press [Tab] again, it will show you a list of the possible options:

```
science.txt      scientific.txt
```

By typing an additional **c**, and then pressing [Tab] again, you can make it auto-complete the filename.

Another feature that can save you a lot of time is cycling through the command history with the [Up] and [Down] arrows. Press the [Up] arrow and the Terminal will show you your previous command. Once you've found the command you want to run again, you can just press [Return] and you will have saved yourself the time it takes to type the command. Press the [Down] arrow to go forward in your command history.

## 13 Searching the contents of a file

### Simple searching using less

Using **less**, you can search though a text file for a keyword (pattern). For example, to search through **science.txt** for the word 'science', type

```
less science.txt
```

then, still in **less**, type a forward slash [/] followed by the word to search

```
/science
```

As you can see, **less** finds and highlights the keyword. Type [n] to search for the next occurrence of the word.

### grep (don't ask why it is called grep)

**grep** is one of many standard UNIX utilities. It searches files for specified words or patterns. First clear the screen, then type

```
grep science science.txt
```

As you can see, **grep** has printed out each line containing the word science. Or has it? Try typing

```
grep Science science.txt
```

The **grep** command is case sensitive; it distinguishes between 'Science' and 'science'. To ignore upper/lower case distinctions, use the **-i** option, i.e. type

```
grep -i science science.txt
```

To search for a phrase or pattern, you must enclose it in single quotes (the apostrophe symbol). For example to search for 'spinning top', type

```
grep -i 'spinning top' science.txt
```

Some of the other options of `grep` are:

- v display those lines that do NOT match
- n precede each matching line with the line number
- c print only the total count of matched lines

Try some of them and see the different results. Don't forget, you can use more than one option at a time. For example, the number of lines without the words 'science' or 'Science' is

```
grep -ivc science science.txt
```

## wc (word count)

A handy little utility is the `wc` command, short for word count. To do a word count on `science.txt`, type

```
wc -w science.txt
```

To find out how many lines the file has, type

```
wc -l science.txt
```

## 14 Redirection

Most processes initiated by commands write to the standard output (that is, they write to the terminal screen), and many take their input from the standard input (that is, they read it from the keyboard). There is also the standard error, where processes write their error messages, by default, to the terminal screen.

We have already seen one use of the `cat` command to write the contents of a file to the screen.

Now type `cat` without specifying a file to read

```
cat
```

Then type a few words on the keyboard and press the [Return] key. Finally, hold the [Ctrl] key down and press [d] (written as ^D for short) to end the input.

What has happened? If you run the `cat` command without specifying a file to read, it reads the standard input (the keyboard), and on receiving the 'end of file' (^D), copies it to the standard output (the screen).

We can redirect both the input and the output of commands.

## 15 Redirecting the Output

We use the `>` symbol to redirect the output of a command. For example, to create a file called `list1` containing a list of fruit, type

```
cat > list1
```

Then type in the names of some types of fruits. Press [Return] after each one.

```
pear  
banana  
apple  
^D
```

Note: Remember that `^D` means pressing [Ctrl] and [d] to stop

What happens is the `cat` command reads the standard input (the keyboard) and the `>` redirects the output, which normally goes to the screen, into a file called `list1`.

To read the contents of the file, type

```
cat list1
```

### Exercise 5

Using the above method, create another file called `list2` containing the following fruit: orange, plum, mango, grapefruit. Read the contents of `list2`.

### Appending to a file

The form `>>` appends standard output to a file, which means it is added to the end of the file. So to add more items to the file `list1`, type

```
cat >> list1
```

Then type in the names of more fruit

```
peach
grape
orange
^D
```

To read the contents of the file, type

```
cat list1
```

You should now have two files. One contains six types of fruit, the other contains four types of fruit. We will now use the `cat` command to join (concatenate) `list1` and `list2` into a new file called `biglist`. Type

```
cat list1 list2 > biglist
```

What this is doing is reading the contents of `list1` and `list2` in turn, then outputting the text to the file `biglist`.

To read the contents of the new file, type

```
cat biglist
```

## 16 Redirecting the Input

We use the `<` symbol to redirect the input of a command.

The command `sort` alphabetically or numerically sorts a list. Type

```
sort
```

Then type in the names of some animals. Press [Return] after each one.

```
dog
cat
bird
ape
^D
```

The output will be

```
ape
```

```
bird  
cat  
dog
```

Using `<` you can redirect the input to come from a file rather than the keyboard. For example, to sort the list of fruit, type

```
sort < biglist
```

and the sorted list will be output to the screen. We can reverse the order in which the list is sorted by using the `-r` option. Type

```
sort -r < biglist
```

To output the sorted list to a file, type,

```
sort < biglist > slist
```

Use cat to read the contents of the file `slist`.

## 17 Pipes

We saw earlier how we could get a list of the files and directories in our home directory using the command `ls`. This command automatically sorts this list for us. But what if we wanted to get a list of all files and directories in reverse order, i.e. from 'z' to 'a'? One method to get a sorted list of names is to type,

```
ls ~ > names.txt  
sort -r < names.txt
```

This is a bit slow and you have to remember to remove the temporary file called `names` when you have finished. What you really want to do is connect the output of the `ls` command directly to the input of the `sort` command. This is exactly what pipes do. The symbol for a pipe is the vertical bar `|`.

For example, typing

```
ls ~ | sort -r
```

will give the same result as above, but quicker and cleaner.

To find out how many files and directories we have in our home-directory, type

```
ls ~ | wc -l
```

## Exercise 6

Using pipes, display all lines of **list1** and **list2** containing the letter 'p', and sort the result.

## 18 Wildcards

### The \* wildcard

The character **\*** is called a wildcard, and will match against none or more character(s) in a file (or directory) name. For example, in your **UCHFall2010** directory, type

```
ls list*
```

This will list all files in the current directory starting with **list**....

Try typing

```
ls *list
```

This will list all files in the current directory ending with ...**list**.

### The ? wildcard

The character **?** will match exactly one character. So **?ouse** will match files like **house** and **mouse**, but not **grouse**.

Try typing

```
ls ?list
```

## 19 Filename conventions

We should note here that a directory is merely a special type of file. So the rules and conventions for naming files apply also to directories. In naming files, characters with special meanings such as **/**, **\***, **&**, and **%** should be avoided. Also, avoid using spaces within names. The safest way to name a file is to use only alphanumeric characters, that is, letters and numbers, together with **\_** (underscore) and **.** (dot).

## 20 Getting Help

### The help option

Most commands you will use in the Ubuntu terminal window will have some sort of help message that tells you which options a particular command can take, and how each option modifies the behavior of the command. This help message is usually displayed by invoking the command with the `--help` or `-h` option. Some commands support both, some support only one of these, and for others these two options might produce different help messages. For example, to find out more about the `sort` command, type

```
sort --help
```

In case the help message is too large, you can pipe it to less to read through it more easily:

```
sort -help | less
```

### man (manual)

There are also exist manual pages, which give you more detailed information about most commands. The manual pages tell you which options a particular command can take, and how each option modifies the behavior of the command. Type `man <command>` to read the manual page for a particular command.

For example, to find out more about the `wc` (word count) command, type

```
man wc
```

Alternatively

```
whatis wc
```

gives a one-line description of the `wc` command, but omits any information about options etc.

### apropos

When you are not sure of the exact name of a command,

```
apropos KEYWORD
```

will give you the commands with **KEYWORD** in their manual page header. For example, try typing

```
apropos copy
```

## 21 Changing the keyboard layout to Danish or US

Ubuntu has the US/International keyboard layout as its standard keyboard layout. For those of you who have not memorized where those keys are located, you can change the keyboard layout in Ubuntu. Select *System > Preferences > Keyboard* and go to the **Layout** pane. Click on **Add** and select Danish from one of the lists. Click on **Add** within that selection window and you should now see **Denmark** as one of the possible keyboard layouts. If you're certain you only want to use the Danish layout, move it to the top of the list using **Move Up**, click on **Apply System-Wide...** and it should be switched to Danish.

## 22 Summary

Command	Meaning
ls	list files and directories
ls -a	list all files and directories
mkdir	make a directory
cd directory	change to named directory
cd	change to home-directory
cd ~	change to home-directory
cd ..	change to parent directory
pwd	display the path of the current directory
cp file1 file2	copy file1 and call it file2
mv file1 file2	move or rename file1 to file2
rm file	remove a file
rmdir directory	remove a directory
cat file	display a file
less file	display a file a page at a time
head file	display the first few lines of a file
tail file	display the last few lines of a file
grep 'keyword' file	search a file for keywords
wc file	count number of lines/words/characters in file
command > file	redirect standard output to a file
command >> file	append standard output to a file
command < file	redirect standard input from a file
command1   command2	pipe the output of command1 to the input of command2
cat file1 file2 > file0	concatenate file1 and file2 to file0
sort	sort data
*	match any number of characters

<code>?</code>	match one character
<code>--help, -h</code>	display the help message of a command
<code>man command</code>	read the online manual page for a command
<code>whatis command</code>	brief description of a command
<code>apropos keyword</code>	match commands with keyword in their man pages