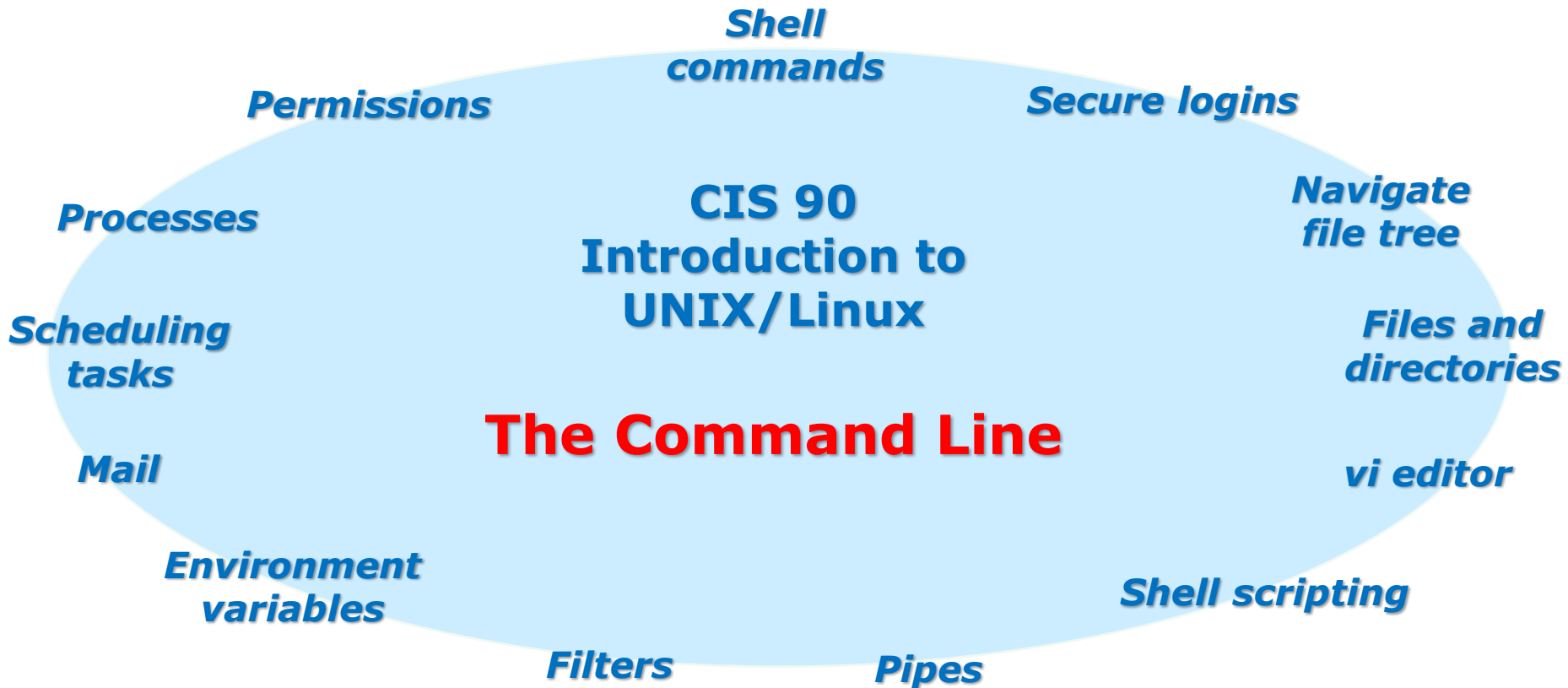**Rich's lesson module checklist**

Last updated 09/18/2018

- ❑ Zoom recording named and published for previous lesson

- ❑ Slides and lab posted
- ❑ Print out agenda slide and annotate page numbers

- ❑ 1st minute quiz
- ❑ Flash cards
- ❑ Calendar page updated

- ❑ VTEA forum post
- ❑ Linux home loan inventory

- ❑ Lab 4 tested
- ❑ check4 feedbot (update data/user-pod-map file)
- ❑ scripts/schedule-submit-locks

- ❑ Enlightenment script tested
- ❑ Check example long file, /usr/share/doc/sudo-1.8.19p2/ChangeLog for change (Viewing Text Files)
- ❑ Check example kernel file for change (Basic File Classifications)

- ❑ 9V backup battery for microphone
- ❑ Backup slides, CCC info, handouts on flash drive
- ❑ Key card for classroom door

- ❑ https://zoom.us

- ❑ Putty, slides, Chrome
- ❑ Enable/Disable attendee sharing
  ^ > Advanced Sharing Options > Only Host
- ❑ Enable/Disable attended annotations
  Share > More > Disable Attendee Sharing

Shell commands

Permissions

Secure logins

Processes

Navigate file tree

Scheduling tasks

Files and directories

Mail

vi editor

Environment variables

Shell scripting

Filters

Pipes

CIS 90 Introduction to UNIX/Linux

The Command Line

Student Learner Outcomes

1. Navigate and manage the UNIX/Linux file system by viewing, copying, moving, renaming, creating, and removing files and directories.

2. Use the UNIX features of file redirection and pipelines to control the flow of data to and from various commands.

3. With the aid of online manual pages, execute UNIX system commands from either a keyboard or a shell script using correct command syntax.

2

Introductions and Credits

Jim Griffin
- Created this Linux course
- Created Opus and the CIS VLab
- Jim's site: https://web.archive.org/web/20140209023942/http://cabrillo.edu/~jgriffin/

Rich Simms
- HP Alumnus
- Started teaching this course in 2008 when Jim went on sabbatical
- Rich's site: http://simms-teach.com

And thanks to:
- John Govsky for many teaching best practices: e.g. the First Minute quizzes, the online forum, and the point grading system. John's site: http://teacherjohn.com/

- Jaclyn Kostner for many webinar best practices: e.g. mug shot page.

Student checklist - Before class starts

1. Browse to:
   http://simms-teach.com
2. Click the **CIS 90** link.
3. Click the **Calendar** link.
4. Locate today's lesson.
5. Find the **Presentation slides** for the lesson and **download** for easier viewing.
6. Click the **Enter virtual classroom** link to join ConferZoom.
7. Log into Opus-II with Putty or ssh command.

4

Student checklist - Before class starts

☐ *Google*

☐ *ConferZoom*

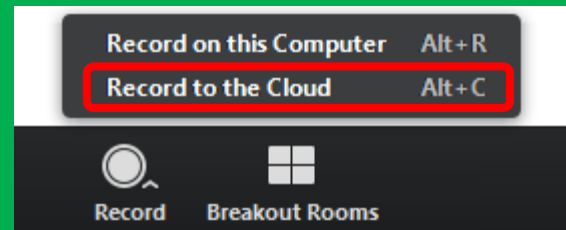☐ *Downloaded PDF of Lesson Slides. I like Foxit Reader so I can take notes using annotations.*

☐ *CIS 90 website Calendar page*

☐ *One or more login sessions to Opus-II*

Start

Start Recording

Audio Check

Start Recording

Audio & video Check

Instructor: **Rich Simms**
Dial-in: **408-638-0968 (toll)**
Meeting ID: **426 283 384**

Mikey Jona Joseph Tara Marie Fredi Carina Isaac Matthew
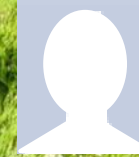
Erik Tony Branden Dominic Ryan L. Alejandra Blair Zari
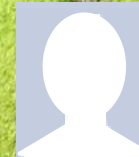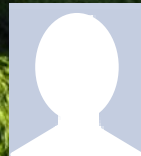
Victor Danny Gabriel Janelly Austin Aaron Ryan M.
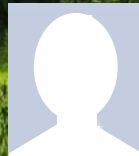
Email me (risimms@cabrillo.edu) a relatively current photo of your face for 3 points extra credit
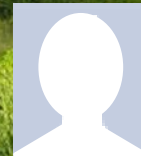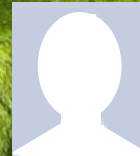
Network Check
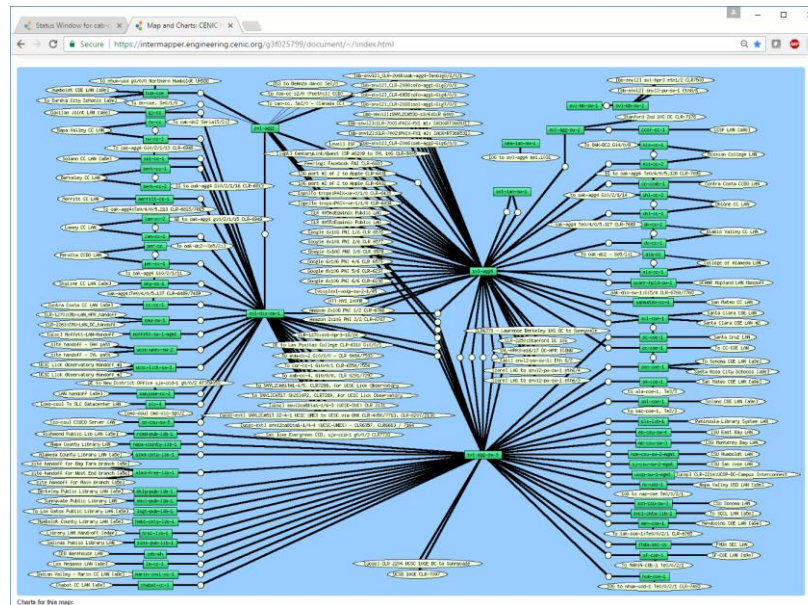
https://intermapper.engineering.cenic.org/g3f025799/document/~/!index.html

First Minute Quiz

Please answer these questions **in the order** shown:

Use CCC Confer White Board

email answers to: risimms@cabrillo.edu

(answers must be emailed within the first few minutes of class for credit)

The UNIX/Linux File System

Objectives	Agenda
• Become familiar with the UNIX file hierarchy. • Be able to navigate the hierarchy using cd, ls and pwd commands. • Understand the key elements of a file. • Be able to distinguish the different UNIX files types. • Learn appropriate commands to view file contents.	• Quiz • Questions • Housekeeping • The UNIX file tree • Navigating the file tree • Unix files • UNIX filename conventions • Viewing text files • Viewing binary files • Basic file types • Further classification of files • Pathnames • Absolute pathnames • Relative pathnames • / . .. and ~ directories • Shell tips • Using pathnames as arguments • More on cd, pwd and ls commands • Home directories • Filename expansion with * • The path to enlightenment • Assignment and wrap up

12

Class Activity

```
        _
     ('v')
     \/-=-\/
     (\_=_/)
      ~~ ~~
Welcome to Opus II
Serving Cabrillo College
```
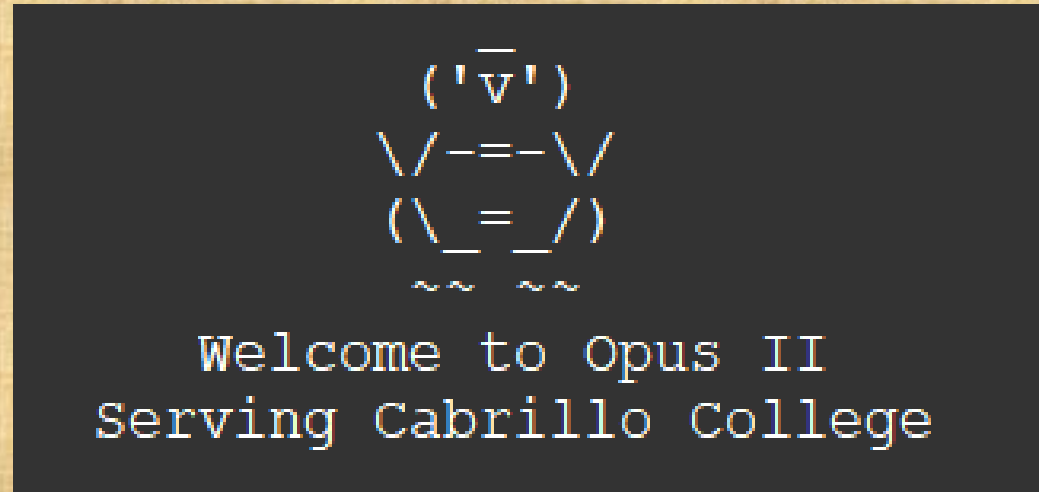
If you haven't already, log into Opus-II

Class Activity

https://simms-teach.com/cis90calendar.php

If you haven't already, download the lesson slides

Class Activity

Read/skim Lesson 1 slides
Student Survey
Lab 1

ConferZoom
- Enter virtual classroom
- Class archives

Quiz 1

Commands
- Understand how the UNIX login operation

https://simms-teach.com/cis90calendar.php

If you haven't already, join ConferZoom classroom

Questions

Questions?

· Graded work in home directories

· Answers in /home/cis90/answers

Lesson material?

Labs?   Tests?

How this course works?

Who questions much, shall learn much, and retain much.
- Francis Bacon

If you don't ask, you don't get.
- Mahatma Gandhi

Chinese Proverb	他問一個問題，五分鐘是個傻子，他不問一個問題仍然是一個傻瓜永遠。
	He who asks a question is a fool for five minutes; he who does not ask a question remains a fool forever.

17

Graded work is copied to your home directories

`ls`

```
simben90@oslab:~
/home/cis90/simben $ ls
archives     empty      Lab2.0   Miscellaneous   proposal2   text.err   uhistory.bak
bigfile      Hidden     Lab2.1   mission         proposal3   text.fxd   what_am_i
bin          lab01.graded   letter   Poems              small_town   timecal
dead.letter  lab02.graded   log      proposal1       spellk      uhistory
/home/cis90/simben $
```

*Log in to Opus-II and use the **ls, cat,** or
more commands to see your graded work*

`cat lab02.graded`

```
simben90@oslab:~
/home/cis90/simben $ cat lab02.graded

GRADING RUBRIC (30 points total)
27 points  for entering the commands on Opus necessary to do
           each step of Lab 2. The instructor will scan
           the commands in your user account's history file
           and take off a point for any missing commands.

 3 points  for correct answers to the three questions asked by
           the submit script (1 point each)

+1 Q4 extra credit answer correct
+1 Q5 extra credit answer correct
```

The answers/ directory on Opus

cat /home/cis90/answers/quiz02

cat /home/cis90/answers/lab02

The answers to quizzes, tests and labs will be posted to the /home/cis90/answers/ directory after the due date has passed.

19

Where to find your grades

Send me your survey to get your LOR code name.

The CIS 90 website
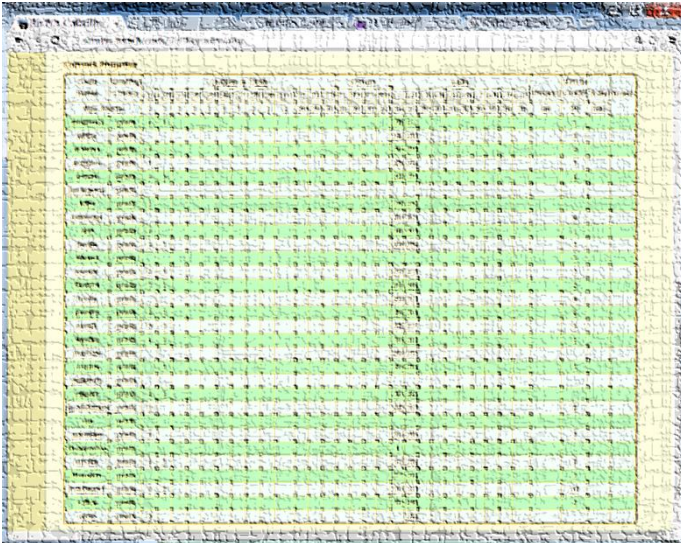
http://simms-teach.com/cis90grades.php

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	504 or higher	A	Pass
80% to 89.9%	448 to 503	B	Pass
70% to 79.9%	392 to 447	C	Pass
60% to 69.9%	336 to 391	D	No pass
0% to 59.9%	0 to 335	F	No pass

At the end of the term I'll add up all your points and assign you a grade using this table

On Opus-II

checkgrades *codename*
(where codename is your LOR codename)
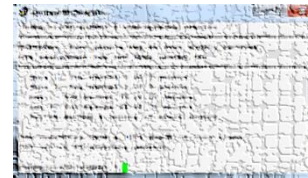
Written by Jesse Warren a past CIS 90 Alumnus

Points that could have been earned:
2 quizzes: 6 points
2 labs: 60 points
Total: 66 points

20

Review your progress in the course

Check the website Grades page

http://simms-teach.com/cis90grades.php
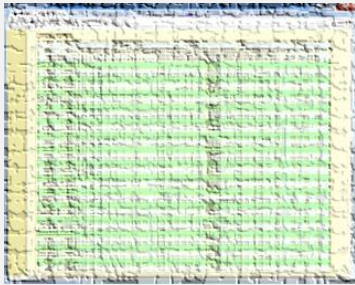
Or check on Opus-II

checkgrades *codename*
(where codename is your LOR codename)
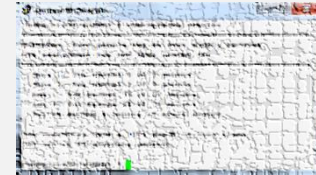
Written by Jesse Warren a past CIS 90 Alumnus

- **Send me your survey to get your LOR codename.**
- **Graded labs and tests are in your home directories.**

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	504 or higher	A	Pass
80% to 89.9%	448 to 503	B	Pass
70% to 79.9%	392 to 447	C	Pass
60% to 69.9%	336 to 391	D	No pass
0% to 59.9%	0 to 335	F	No pass

Points that could have been earned:
2 quizzes: 6 points
2 labs: 60 points
Total: **66 points**

At the end of the term I'll add up all your points and assign you a grade using this table

21

Extra Credit

On the forum

Be sure to monitor the forum as I may post extra credit opportunities without any other notice!

On some labs

Extra credit (2 points)

For a small taste of what you would learn in CIS 191 let's add a new user to your Arya VM. Once added we will see how the new account is represented in /etc/passwd and /etc/shadow.

1. Log into your Arya VM as the cis90 user. Make sure it's your VM and not someone else's.

2. Install the latest updates:
   ```
   sudo apt-get update
   sudo apt-get upgrade
   ```

3. Add a new user account for yourself. You may make whatever username you wish. The example below shows how Benji would make the same username he uses on Opus:
   ```
   sudo useradd -G sudo -c "Benji Simms" -m -s /bin/bash simben90
   ```

In lesson slides (search for extra credit)

LinkedIn
Computer Science and
Computer Information Systems at Cabrillo College

For 3 points extra credit:
1) Join LinkedIn.com
2) Join this group
3) Send me an email when finished.

On the website

http://simms-teach.com/cis90grades.php

For some flexibility, personal preferences or family emergencies there is an additional 90 points available of **extra credit** activities.

http://simms-teach.com/cis90extracredit.php

- **Web site content review** - The first person to email the instructor pointing out an error or typo on this website will get one point of extra credit for each unique error. The email must specify the specific document or web page, pinpoint the location of the error, and specify what the correction should be. Duplicate errors count as a single point. This does not apply to pre-published material that has been uploaded but not yet presented in class. (Up to 20 points total)

22

Lab Assignments -- Pearls of Wisdom
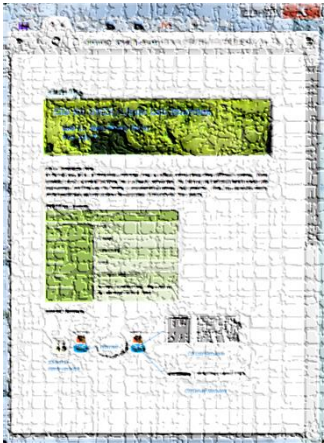
- Don't wait till the last minute to start.

- Plan for things to go wrong and give yourself time to ask questions and get answers.

- The *slower* you go the *sooner* you will be finished.

- A few minutes reading the forum can save you hour(s).

- Line up materials, references, equipment and software ahead of time.

- It's best if you fully understand each step as you do it. Use Google or refer back to lesson slides to understand the commands you are using.

- Keep a growing cheat sheet of commands and examples.

- Study groups are very productive and beneficial.

- Use the forum to collaborate, ask questions, get clarifications and share tips you learned while doing a lab.

- **Late work is not accepted** so submit what you have for partial credit.

23

Getting Help When Stuck on an Assignment

- Google the topic/error message.

- Search the Lesson Slides (they are PDFs) for a relevant example on how to do something.

- Check the forum. Someone else may have run into the same issue and found a way past it. If not start a new topic, explain what you are trying to do and what you have tried so far.

- Talk to a STEM center tutor/assistant.

- Come see me during my office or lab hours:
  https://www.cabrillo.edu/salsa/listing.php?staffId=1426
  I'm in the CTC (room 1403) every Tuesday from 3:30-5:00 pm.

- Make use of the Open Questions time at the start of every class.

- Make a cheat sheet of commands and examples so you never again get stuck on the same thing!

CIS Labs always involve some troubleshooting!

24

CTC - Building 1400
On lower campus
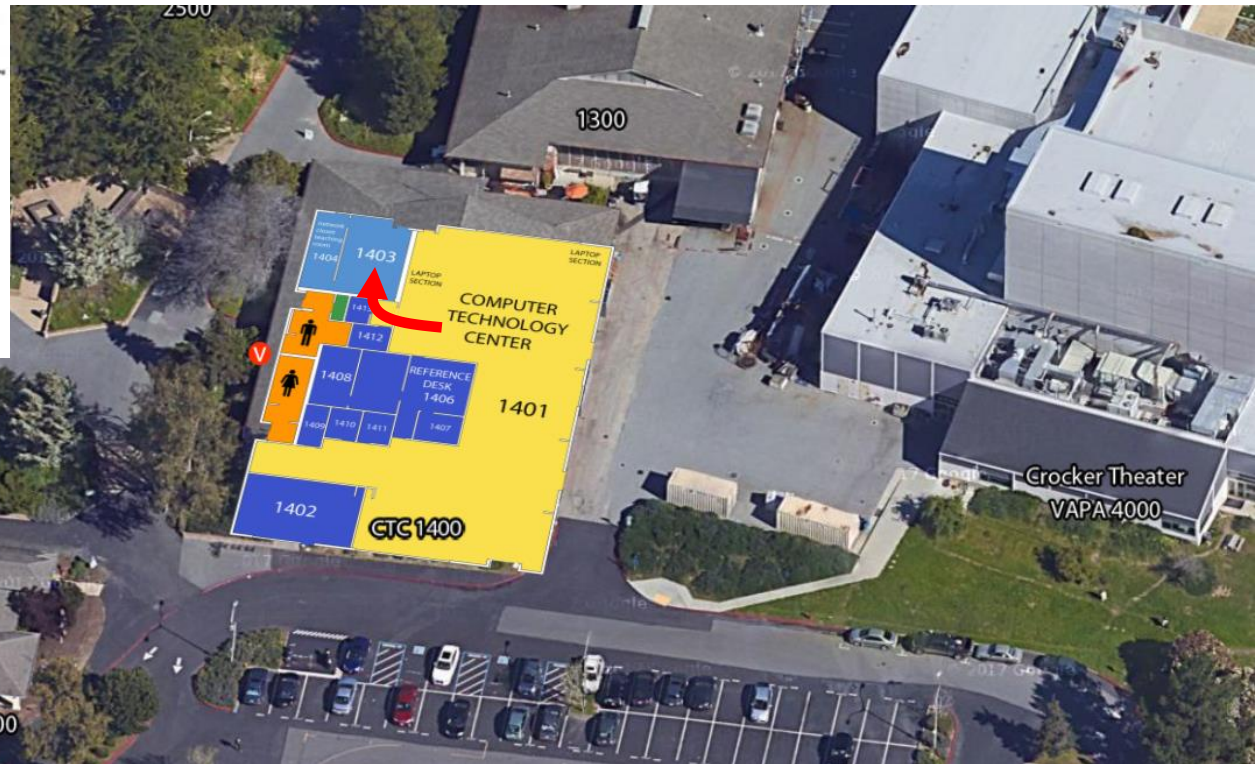
I will be in the CTC (room 1403) every Tuesday afternoon from 3-5:30

Help Available in the CIS Lab

Instructors, lab assistants and equipment are available for CIS students to work on assignments.

The CIS Lab

Inside the STEM Center

Rich's Cabrillo College CIS Classes
Home Page

Home | Resources | Forums | CIS Lab | Canvas

To see schedule, click the CIS Lab link on the website and use the "Week" calendar view

26

The slippery slope

1) If you didn't submit the last lab ...

2) If you were in class and didn't submit the last quiz ...

3) If you didn't send me the student survey assigned in Lesson 1 ...

4) If you haven't made a forum post in the last quarter of the course ...

Please contact me by email, see me during my office hours or when I'm in the CTC

Email: risimms@cabrillo.edu

27

Housekeeping

Pause/Stop Recording

Pause Recording

Audio Check

Roll Call

If you are watching the archived video please email me to let me know you were here.

risimms@cabrillo.edu

Resume/Stop Recording
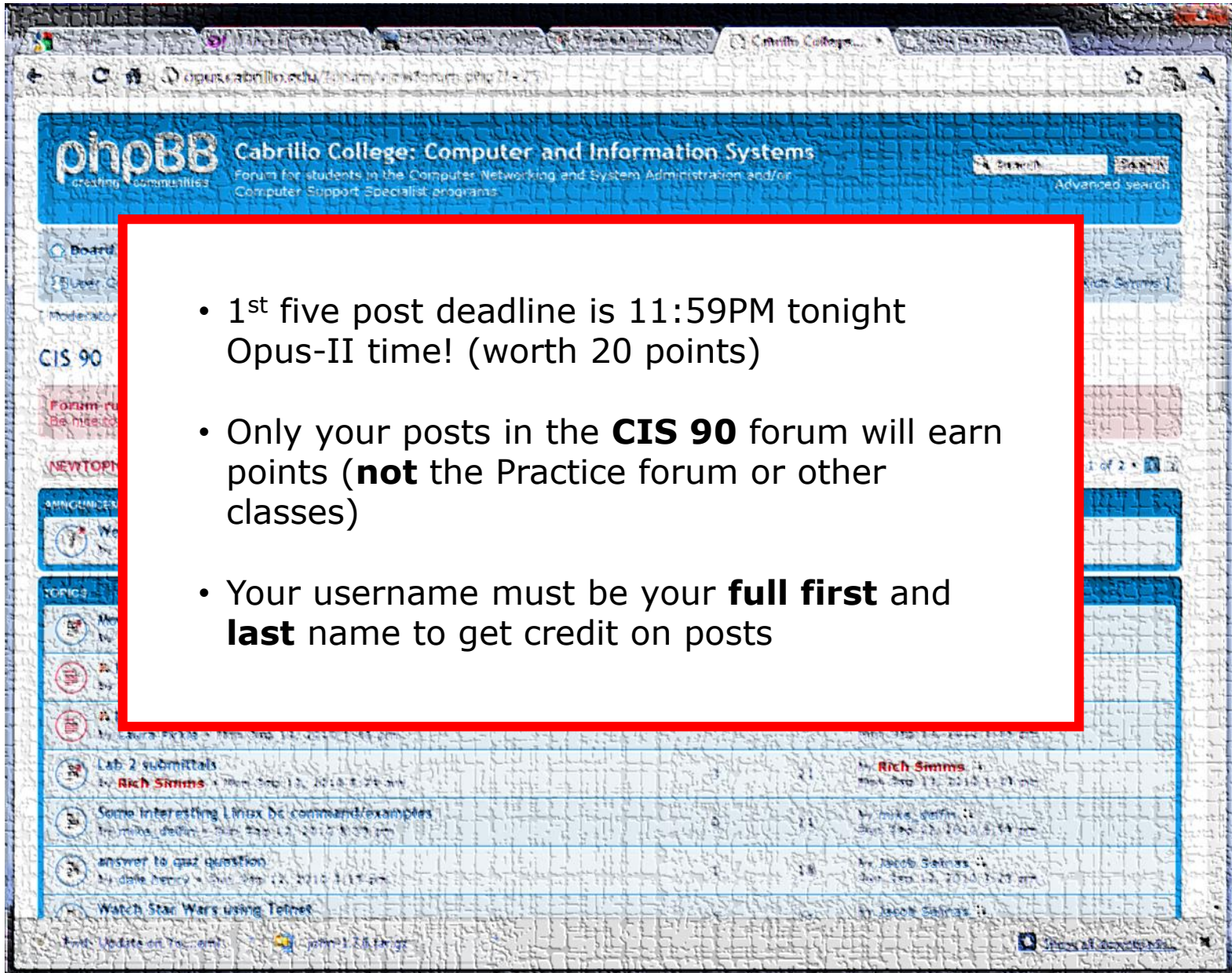
Resume Recording

Audio Check

- Lab 3 due tonight at 11:59PM (Opus-II time)
    - Use **check3** to review your collection.
    - Clean up duplicates before last submittal.
    - I'll grade using a variation of **check3** script.
    - Don't forget to use **submit** to turn in your work!

- Five forum posts due tonight at 11:59PM (Opus-II time).

- Reminder - all quizzes, all tests, all due dates for all work is on the website Calendar page.
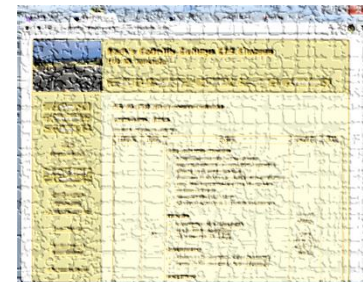
- 1st five post deadline is 11:59PM tonight Opus-II time! (worth 20 points)

- Only your posts in the **CIS 90** forum will earn points (**not** the Practice forum or other classes)

- Your username must be your **full first** and **last** name to get credit on posts

34

Perkins/VTEA Survey

https://opus-ii.cis.cabrillo.edu/forum/viewtopic.php?f=7&t=559

This is an important source of funding for Cabrillo College.

*Send me an email stating you completed this Perkins/VTEA survey for **three points extra credit!***

Even if you took the survey in another CIS class!

35

Linux Computer Home Loans

https://docs.google.com/a/cabrillo.edu/spreadsheets/d/1ljwkXZ7BYcCCo3UwqHz0EPm2I3OMSYMYrfYv43C2MBc/edit?usp=sharing

Email me if you are interested in getting a Linux PC home loan. Based on the number of requests I'll determine how long they can be checked out for.

LPI Linux Essentials Certificate

Linux Essentials Certificate of Achievement				
Objective	# of Questions	Cabrillo	Urban Penguin	NDG Linux Essentials
Topic 1: The Linux Community and a Career in Open Source				
1.1 Linux Evolution and Popular Operating Systems	2	CIS90 Lesson 1	1.1	Module 1
1.2 Major Open Source Applications	2	CIS90 Lesson 1	1.2	Module 2
1.3 Understanding Open Source Software and Licensing	1	CIS90 Lesson 1	1.3	Module 2
1.4 ICT Skills and Working in Linux	2	not covered	1.4	Module 3
Topic 2: Finding Your Way on a Linux System				
2.1 Command Line Basics	2	CIS90 Lesson 2	2.1	Module 4
2.2 Using the Command Line to Get Help	2	CIS90 Lesson 2	2.2	Module 5
2.3 Using Directories and Listing Files	2	CIS 90 Lesson 4	2.3	Module 6
2.4 Creating, Moving and Deleting Files	2	CIS90 Lesson 5	2.4	Module 6
Topic 3: The Power of the Command Line				
3.1 Archiving Files on the Command Line	2	CIS 90 Lesson 14	3.1	Module 7
3.2 Searching and Extracting Data from Files	4	CIS 90 Lesson 8	3.2	Module 8
3.3 Turning Commands into a Script	4	CIS 90 Lesson 13 & 14	3.3	Module 9
Topic 4: The Linux Operating System				
4.1 Choosing an Operating System	1	not covered	4.1	Module 1
4.2 Understanding Computer Hardware	2	CIS 90 Lesson 1	4.2	Module 10
4.3 Where Data is Stored	3	CIS 90 Lesson 1	4.3	Module 11
4.4 Your Computer on the Network	2	CIS 192	4.4	Module 12
Topic 5: Security and File Permissions				
5.1 Basic Security and Identifying User Types	2	CIS 191	5.1	Module 13
5.2 Creating Users and Groups	2	CIS 191	5.2	Module 14
5.3 Managing File Permissions and Ownership	2	CIS 90 Lesson 7	5.3	Module 15
5.4 Special Directories and Files	1	CIS 90 Lesson 4	5.4	Module 16

http://www.lpi.org/our-certifications/exam-010-objectives

The Urban Penguin

https://www.theurbanpenguin.com/lpi-training-from-theurbanpenguin/linux-essentials/

No registration, no logging in, just click and watch the videos

NDG Linux Essentials
via Cisco Networking Academy

https://www.netacad.com/
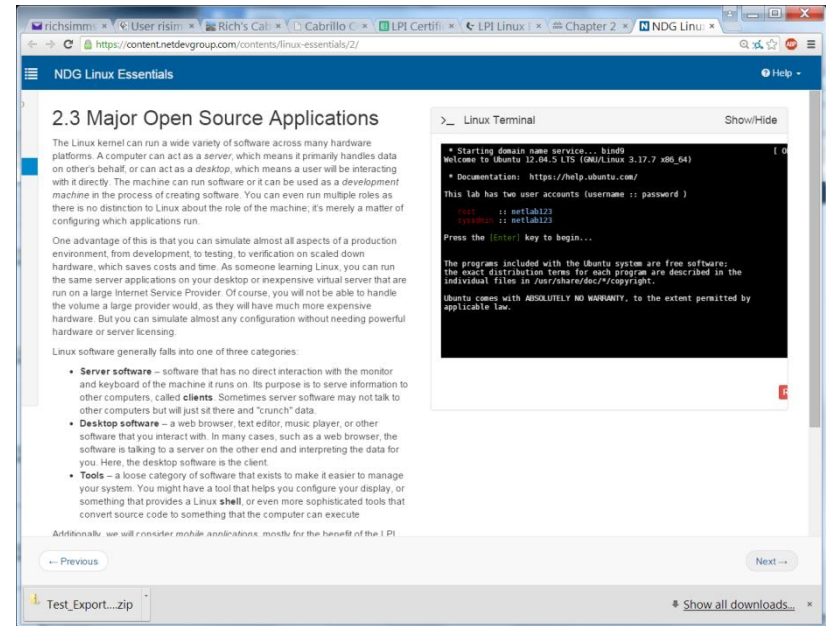
Complete course with reading, live VM and tests.

Contact me if you would like a student account for the NDG Linux Essentials course.

To get notifications of new forum posts

Subscribe to the forum to get email notifications of new posts

After logging in:

1. Go to the CIS 90 class forum.
2. At the bottom of the page, click the "Subscribe forum" link on the lower left. When subscribed you get email notifications when new posts are made.
3. To unsubscribe, click it again.

🏠 **Home** ‹ **Board index** ☑ Subscribe forum *Unsubscribed looks like this.*

🏠 **Home** ‹ **Board index** ☐ Unsubscribe forum *Subscribed looks like this.*

The UNIX File Tree

UNIX File Tree
/ = root of the tree

UNIX File Tree

/ = root of the tree

The / "slash" directory is the top of the tree and has no parent

Directory

/

boot   root   bin   etc   sbin   home   var   lib   usr

mail   ls   passwd   cis90   cis191   rsimms   bin

Not to be confuses with /, this is the root user's home directory

bin   milhom   simben   answers   cal   apropos

bin   Poems   mission   letter

banner   ant

File

Every user gets their own "home" directory to keep their own files and directories

45
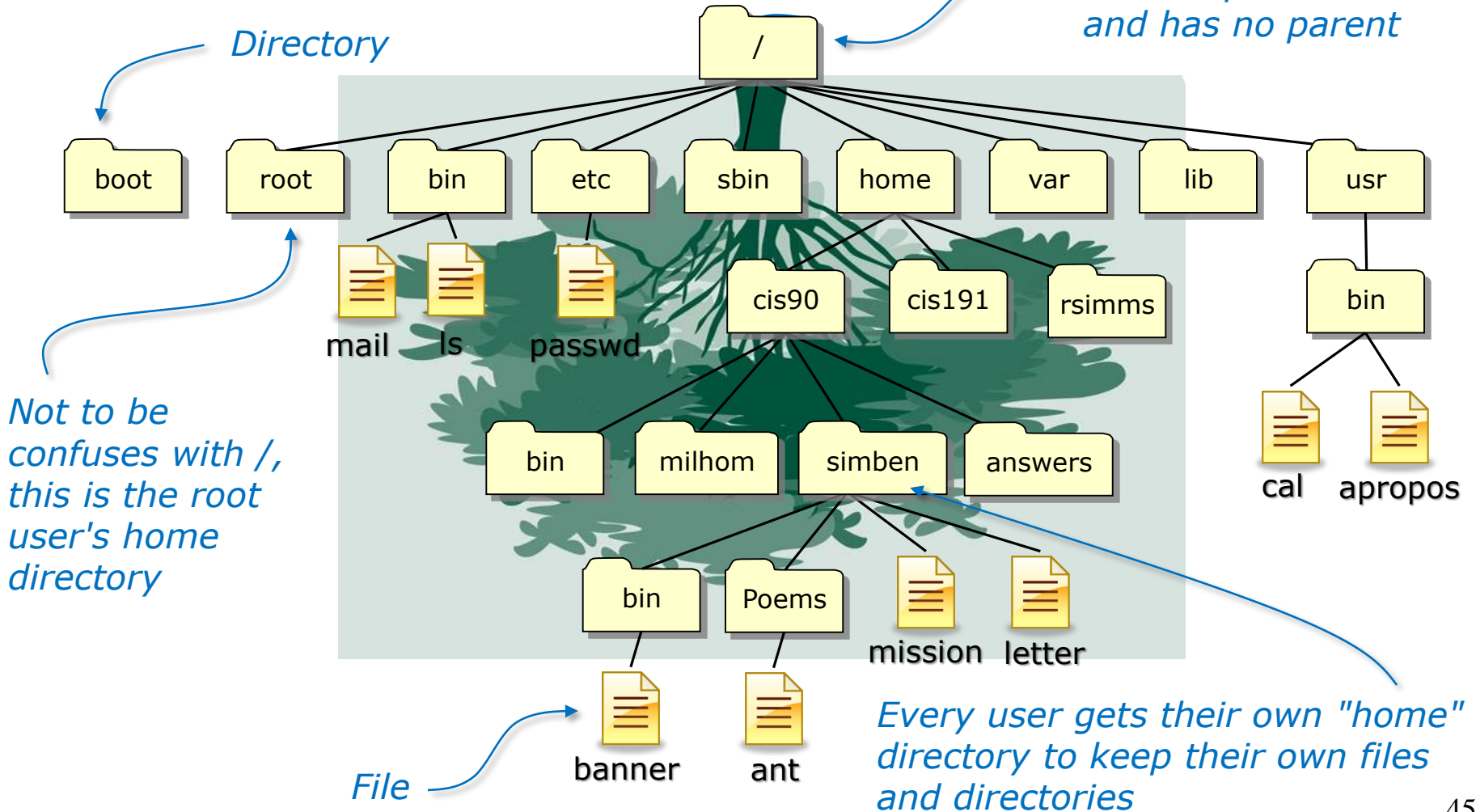
The UNIX/Linux File System Hierarchy

Top-Level Directory	Contents
/bin	binary files forming the commands and shells used by the system administrator and users
/boot	files used during the initial bootup process including the kernel
/dev	device files, like terminals and drives for connected hardware
/etc	system configuration files
/home	individual directories owned by each user
/lib	shared libraries needed to boot the system and run the commands in the root filesystem (i.e. commands in /bin and /sbin)
/lost+found	recovered files that were corrupted by power failures or system crashes
/mnt	mount points for floppies, cds, or other file systems
/opt	add-on software packages and/or commercial applications
/proc	kernel level process information
/root	home directory for the root user
/sbin	system administration commands reserved for the superuser (root)
/tmp	temporary files that are deleted when the system is rebooted or started
/usr	program files and related files for use by all users
/var	log files, print spool files, and mail queues

The CIS 90 student home directories

ls /

```
/home/cis90/simben $ ls /
bin    dev   home   lib64   mnt   proc   run   srv   tmp   var
boot   etc   lib    media   opt   root   sbin  sys   usr
/home/cis90/simben $
```

ls /home

```
/home/cis90/simben $ ls /home
backup   cis90      ehbot02   ehbot04   rsimms
cis76    ehbot01    ehbot03   ledmgr    turnin
/home/cis90/simben $
```

ls /home/cis90

```
/home/cis90/simben $ ls /home/cis90
```

Do you see your home directory in the /home/cis90 directory?

Navigating the UNIX file tree

Navigating the tree
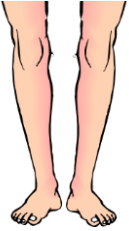
- Use the **cd** command to change directories *(your legs)*

- Use the **ls** command to list files at your current location (your eyes)

- Use the **pwd** command to show your location (your GPS)

Note, as CIS 90 students your shell prompt uses the PWD variable. As you move around the tree your command prompt will change to show your current location.

To see why compare the output of the commands: **pwd** *and* **echo $PWD**

49

UNIX File Tree
Navigate from your home directory up to the / directory

Not all files and
directories are shown

50

Navigate from your home directory to the / directory

```
simben90@opus-ii:/                                                    —   □   ×
/home/cis90/simben $ ls 👁
bigfile            lab02-collection  log          proposal2   text.fxd
bin                lab04-mydata      Miscellaneous proposal3  timecal
empty              Lab2.0            mission      small_town  trash
Hidden             Lab2.1            Poems        spellk      uhistory
lab01-collection   letter            proposal1    text.err    what_am_i
/home/cis90/simben $ cd .. ⫽
/home/cis90 $ ls 👁
angjak   bilfri   chakag  farcia  milhom  padhen  rocces  telnat  winsha
answers  bin      chudar  fuldan  monele  pernat  rodduk  valjos
arrdav   brehil   cis     gunfer  ohapau  plabra  seasky  vanjoa
ausedg   broada   depot   kankim  olscla  ragjet  silcla  watshe
banric   butjus   escchr  klenat  ottlai  ranlui  simben  wilnov
/home/cis90 $ cd .. ⫽
/home $ ls 👁
backup  cis76  cis90  ehbot01  ehbot02  ehbot03  ehbot04  ledmgr  rsimms  turnin
/home $ cd .. ⫽
/ $ ls 👁
bin   dev   home  lib64  mnt   proc  run   srv   tmp   var
boot  etc   lib   media  opt   root  sbin  sys   usr
/ $ ▉
```

*Use **cd ..** to climb up to the parent directory and **ls** to view the directory contents as you go. Notice how the shell prompt reflects your current location in the tree.*

51

UNIX File Tree

Navigate from the / directory down to your Blake directory
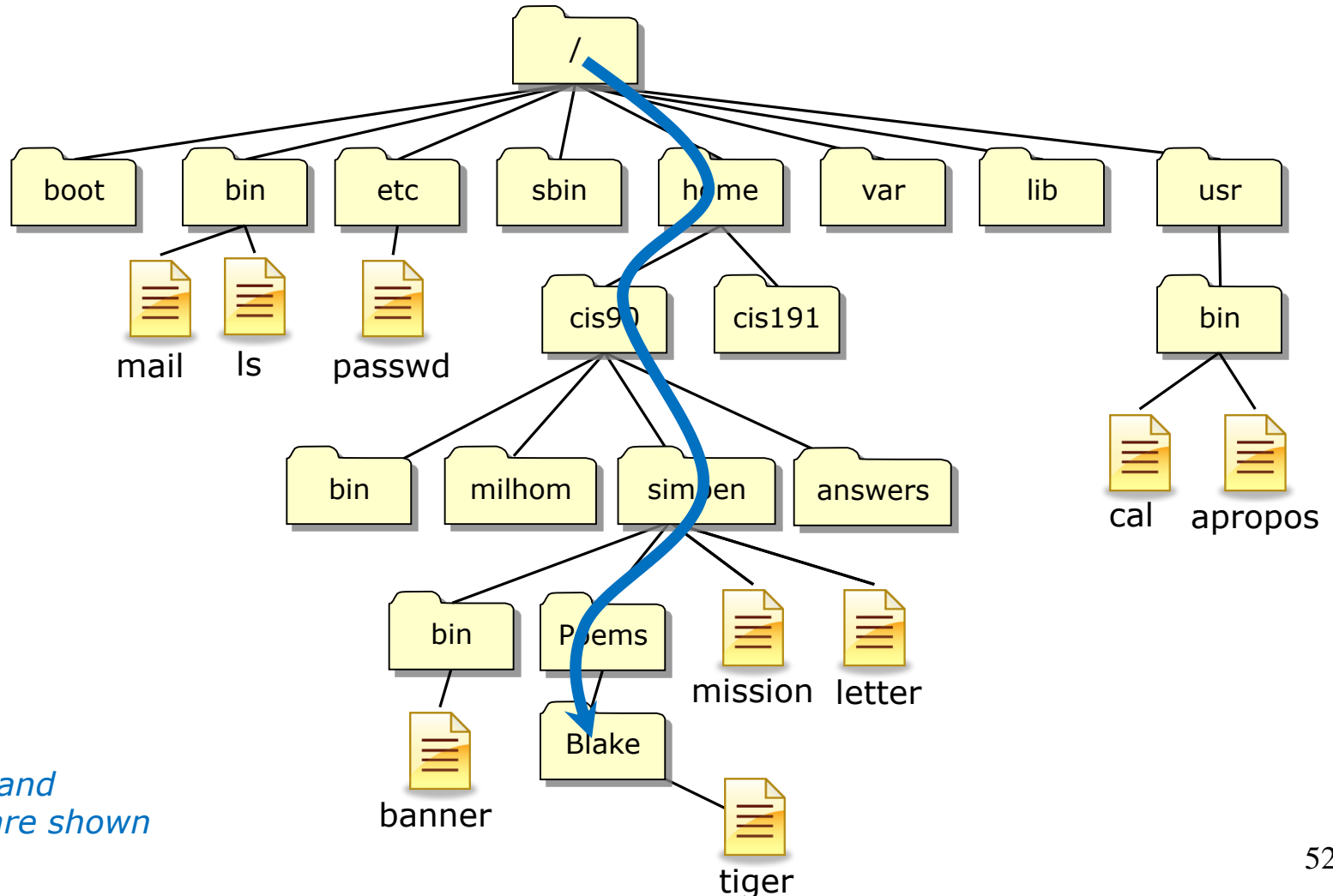
Not all files and directories are shown

Navigate down to the directory of Blake's poems

```
simben90@opus-ii:~/Poems/Blake                                    —    □    ×
/ $ ls  👁
bin     dev    home    lib64   mnt    proc   run    srv    tmp   var
boot    etc    lib     media   opt    root   sbin   sys    usr
/ $ cd home
/home $ ls  👁
backup   cis76   cis90   ehbot01   ehbot02   ehbot03   ehbot04   ledmgr   rsimms   turnin
/home $ cd cis90
/home/cis90 $ ls  👁
angjak    bilfri    chakag    farcia    milhom   padhen   rocces    telnat   winsha
answers   bin       chudar    fuldan    monele   pernat   rodduk    valjos
arrdav    brehil    cis       gunfer    ohapau   plabra   seasky    vanjoa
ausedg    broada    depot     kankim    olscla   ragjet   silcla    watshe
banric    butjus    escchr    klenat    ottlai   ranlui   simben    wilnov
/home/cis90 $ cd simben
/home/cis90/simben $ ls  👁
bigfile            lab02-collection   log             proposal2    text.fxd
bin                lab04-mydata       Miscellaneous   proposal3    timecal
empty              Lab2.0             mission         small_town   trash
Hidden             Lab2.1             Poems           spellk       uhistory
lab01-collection   letter             proposal1       text.err     what_am_i
/home/cis90/simben $ cd Poems/
/home/cis90/simben/Poems $ ls  👁
Angelou   ant   Blake   Dickenson   Neruda   nursery   Shakespeare   twister   Yeats
/home/cis90/simben/Poems $ cd Blake
/home/cis90/simben/Poems/Blake $ ls  👁
jerusalem   tiger
/home/cis90/simben/Poems/Blake $ ▮
```

*Use **cd** <directory> to climb down directory by directory. Notice how the prompt changes to show your location in the Unix file tree*

53

Navigate back to your home directory

```
simben90@opus-ii:~                                                    —  □  ✕
/home/cis90/simben/Poems/Blake $ ls 👁
jerusalem  tiger
/home/cis90/simben/Poems/Blake $ cd 👣
/home/cis90/simben $ ls 👁
bigfile          lab02-collection  log            proposal2   text.fxd
bin              lab04-mydata      Miscellaneous  proposal3   timecal
empty            Lab2.0            mission        small_town  trash
Hidden           Lab2.1            Poems          spellk      uhistory
lab01-collection letter            proposal1      text.err    what_am_i
/home/cis90/simben $ 
```

*You always have the power to go home. Just use the **cd** with <u>no arguments</u> to change back to your home directory*

Dorothy: Oh, will you help me? Can you help me?
Glinda: You don't need to be helped any longer. You've always had the power to go back to Kansas.
Dorothy: I have?
Scarecrow: Then why didn't you tell her before?
Glinda: Because she wouldn't have believed me. She had to learn it for herself.

http://vivandlarry.com/wp-content/uploads/2011/05/oz.jpg

54

Class Field Trip

1) /boot
   - The kernel

2) /etc
   - motd
   - passwd

3) /var
   - mail/
   - www/html

4) /home/cis90/bin
   - depot
   - bin
   - answers

5) /home/cis90/simben/Poems
   - various poem directories

55
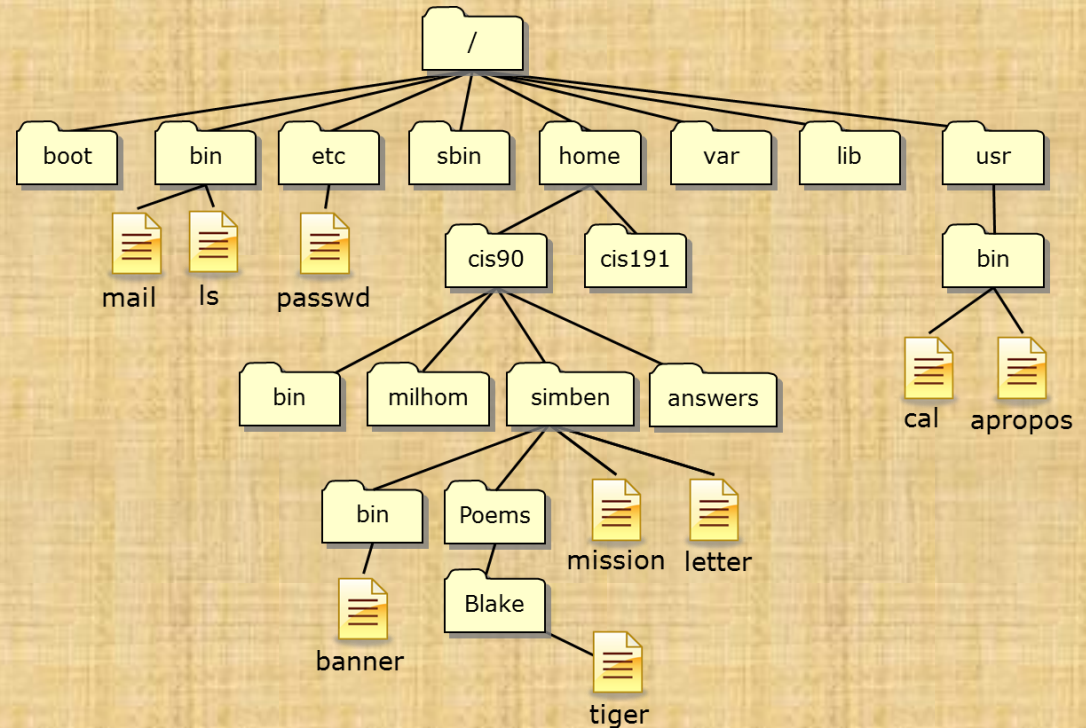
UNIX Files

File Systems
Linux

A typical hard drive

This is where your files actually reside

Linux File Systems

The hard drive is partitioned and the data areas can be formatted as a file system. Linux typically uses ext2, ext3, ext4 and xfs file systems. Windows uses FAT32 and NTFS file systems.

*MBR (Master Boot Record)

Partition Boot Sector

Data

Partition Boot Sector

Data

Partition Boot Sector

Data

Partition Boot Sector

Unused Boot Sector

Data

Unused Boot Sector

Data

extx file system

Superblock

Inode Table

Data Blocks

Hard drives can be partitioned using either MBR or GPT (GUID Partition Table) 58
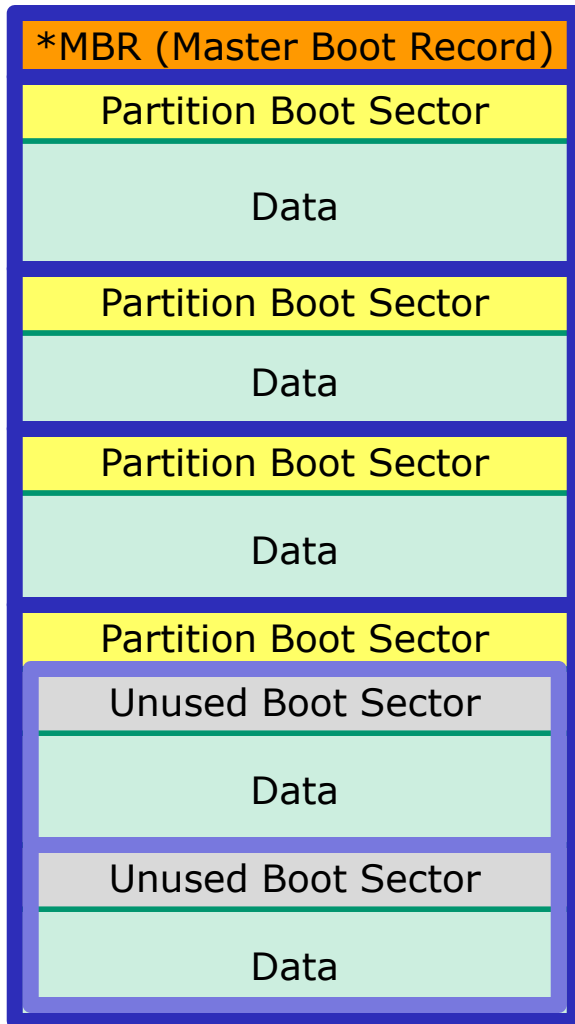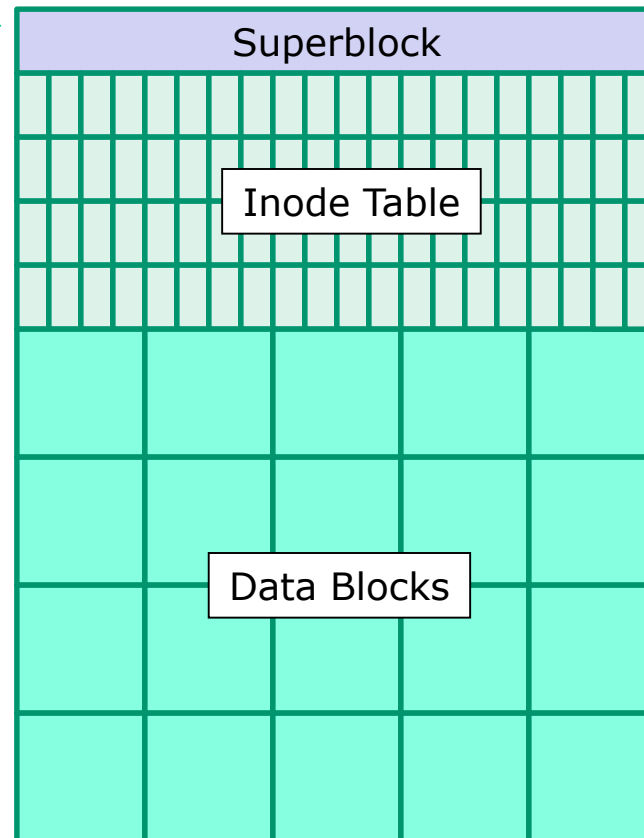
The three elements of a UNIX file

```
/home/cis90/simben/Poems $ ls
ant  Blake  nursery  Shakespeare  twister  Yeats


/home/cis90/simben/Poems $ ls -li twister
102625 -rw-r--r-- 1 simben90 cis90 151 Jul 20  2001 twister


/home/cis90/simben/Poems $ cat twister
A tutor who tooted the flute,
tried to tutor two tooters to toot.
Said the two to the tutor,
"is it harder to toot?  Or to
tutor two tooters to toot?"
```

filename
+
inode
+
data

59

Let's look at the file named letter in Benji's home directory
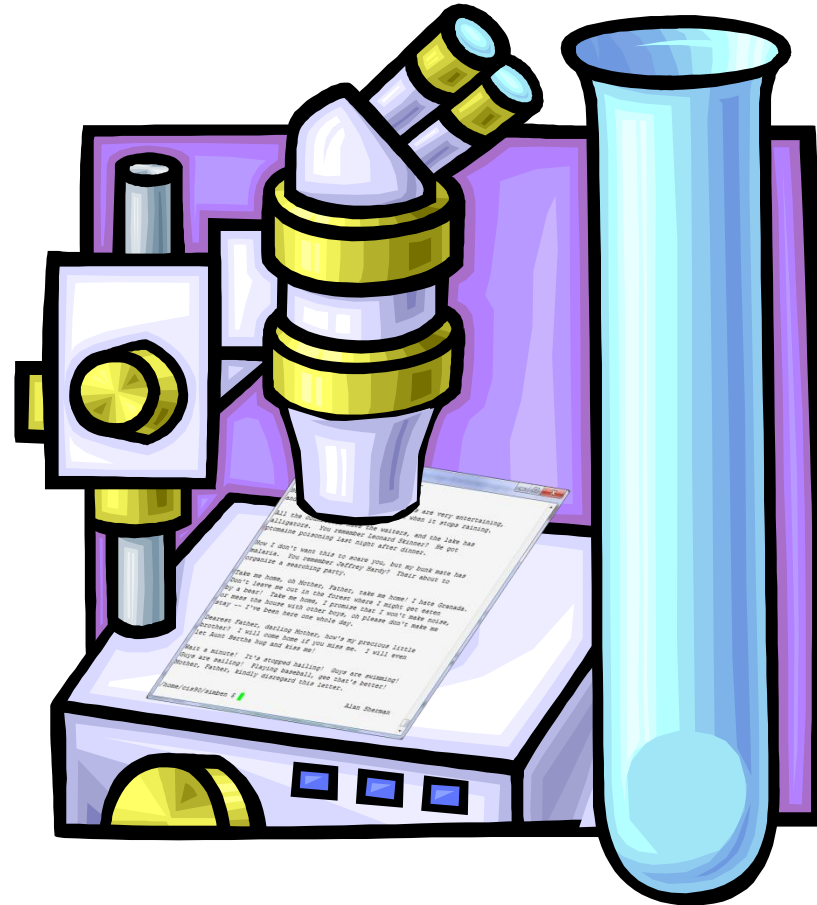
`ls -il letter` *will show the inode number and a long listing of the letter file*
`cat letter` *will show the data contents of the letter file*

filename

```
/home/cis90/simben $ ls -li letter
9662 -rw-r--r--. 1 simben90 cis90 1044 Jul 20  2001  letter
```

inode

```
/home/cis90/simben $ cat letter
```

Hello Mother! Hello Father!

Here I am at Camp Granada. Things are very entertaining,
and they say we'll have some fun when it stops raining.

All the counselors hate the waiters, and the lake has
alligators. You remember Leonard Skinner? He got
ptomaine poisoning last night after dinner.

Now I don't want this to scare you, but my bunk mate has
malaria. You remember Jeffrey Hardy? Their about to
organize a searching party.

Take me home, oh Mother, Father, take me home! I hate Granada.
Don't leave me out in the forest where I might get eaten
by a bear! Take me home, I promise that I won't make noise,
or mess the house with other boys, oh please don't make me
stay -- I've been here one whole day.

Dearest Father, darling Mother, how's my precious little
brother? I will come home if you miss me. I will even
let Aunt Bertha hug and kiss me!

Wait a minute! It's stopped hailing! Guys are swimming!
Guys are sailing! Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

                                Alan Sherman

data

61

bigfile 19470
bin 9628
letter 9662

/home/cis90/simben

*filenames are stored in directories, **not** in inodes*

Hello Mother! Hello Father!

Here I am at Camp Granada. Things are very entertaining,
and they say we'll have some fun when it stops raining.

All the counselors hate the waiters, and the lake has
alligators. You remember Leonard Skinner? He got
ptomaine poisoning last night after dinner.

Now I don't want this to scare you, but my bunk mate has
malaria. You remember Jeffrey Hardy? Their about to
organize a searching party.

Take me home, oh Mother, Father, take me home! I hate Granada.
Don't leave me out in the forest where I might get eaten
by a bear! Take me home, I promise that I won't make noise,
or mess the house with other boys, oh please don't make me
stay -- I've been here one whole day.

Dearest Father, darling Mother, how's my precious little
brother? I will come home if you miss me. I will even
let Aunt Bertha hug and kiss me!

Wait a minute! It's stopped hailing! Guys are swimming!
Guys are sailing! Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

Alan Sherman

Superblock

Inode Table

Data Blocks

ext2 file system

9662	inode number
-	Type
rw-r--r--	Permissions
1	Number of links
simben90	User
cis90	Group
1044	Size
2001-07-20	Modification time
2012-09-17	Access Time
2012-08-01	Change time
Pointer(s) to data blocks	Pointer(s) to data blocks

/home/cis90/simmsben $ **ls -il letter**
9662 -rw-r--r--. 1 simben90 cis90 1044 Jul 20 2001 letter

62

Directories are files too!

- Directories are implemented as files

- The data in a directory includes pairs of filenames and inode numbers (kind of like a phone book)

- Every directory can contain further sub-directories

In other operating systems like Mac and Windows, a directory is often referred to as a "folder" and represented as a office folder icon on the desktop.

Filename Activity

Directories contain filename/inode number pairs.

1) On Opus-II, go to your home directory using:

   `cd`

2) Look at the filename/inode pairs in your home directory using:

   `ls -i`

Type the filename/inode number pair for your letter file in the chat window.

Inode Activity

Every file is associated with an inode. The inode contains various properties about the file.

Show the information in the inode associated with your letter file using a long listing:

```
ls -l letter
```

Look at the output from the long listing. Except for one item everything displayed is a property stored in the inode.

Type the one property not stored in the inode into the chat window.

Data Activity

The contents or date portion of a file is stored in a data block.

Show the data contents of your letter file:

`cat letter`

Read the letter. What is the name of the Summer Camp?

Type this name into the chat window.

Unix Filename Conventions

UNIX file name conventions

Unix filenames are case sensitive

File names can be any combination of the following:
- Upper and lower case letters: **A-Z** and **a-z**
- Numbers: **0-9**
- Periods, underscores, hyphens: **. _ -**
- Examples: letter, Lab2.1, my_files, my-files

Avoid using the following characters in filenames
- **| ; , ! @ # $ ( ) < > / \ " ' ` ~ { } [ ] = + & ^ <space> <tab>**
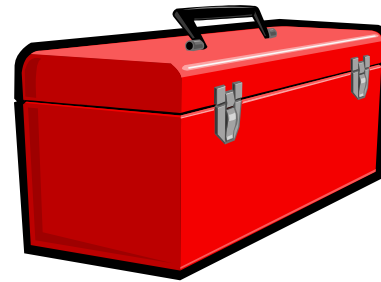
More commands for your toolbox

Viewing Text Files

Lesson 4 commands for your toolbox

	cat	- view a text file
NEW	**more**	- view a large text file by scrolling down
NEW	**less**	- view a large text file by scrolling down and up
NEW	**head**	- view the beginning lines of a text file
NEW	**tail**	- view the last lines of a text file
NEW	**wc**	- count the lines, words and characters in a text file
NEW	**xxd**	- view a binary data file as a hex dump
NEW	**cd**	- change to a different directory
	ls	- list files
NEW	**pwd**	- show name of current/working directory
	file	- show additional file information
	type	- show location of a command on path

Viewing **text** files:

- file   *useful for identifying if a file is text or binary*

- cat   *to print a file*
- more   *to scroll down through a file*
- less   *to scroll down and up a file*
- head   *to print the beginning lines of a file*
- tail   *to print the last lines of a file*
- wc   *count the words and lines in a text file*

ASCII Text Files

Computers store everything as binary 0's and 1's.

ASCII = American Standard Code for Information Interchange.

ASCII defines binary patterns of 0's and 1's to represent printable text characters.

For example, the letter O is represented by 01001111, the letter z is represented by 01111010.

If a file has data that only contains ASCII text patterns then it is considered a **text file** and "printable".

If some or all of the bit patterns are not ASCII characters then the file is considered a **binary file** and unprintable.

To see all the ASCII characters use the **man ascii** command.

Thanks Hunter! See Hunter's post at
http://oslab.cishawks.net/forum/viewtopic.php?f=88&t=2258&p=8357

Identifying text files with the file command

```
/home/cis90/simben $ file letter Poems proposal1 mission uhistory what_am_i
letter:     ASCII English text
Poems:      directory
proposal1:  ASCII English text
mission:    ASCII English text
uhistory:   ASCII mail text
what_am_i:  data
/home/cis90/simben $
```

Look for the word "text" in the output to indicate an ASCII text file

If you don't see "text" it's a binary file and unprintable. Note: what_am_i and Poems are NOT text files

The text viewing commands like cat, more, head, etc. only work on text files. They are not meant to be used to view binary data files or directories.

74

cat command
used to view a text file

```
/home/cis90/simben $ cat letter
Hello Mother!  Hello Father!
```
A single argument, letter, is given to the cat command to process

```
Here I am at Camp Granada.  Things are very entertaining,
and they say we'll have some fun when it stops raining.

All the counselors hate the waiters, and the lake has
alligators.  You remember Leonard Skinner?  He got
ptomaine poisoning last night after dinner.
```

< Snipped >

```
Wait a minute!  It's stopped hailing!  Guys are swimming!
Guys are sailing!  Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

                                    Alan Sherman

/home/cis90/simben $
```

75

cat command
viewing multiple text files

```
/home/cis90/simben $ cat spellk letter
Spell Check


Eye halve a spelling chequer
It came with my pea sea
It plainly marques four my revue
< snipped >
Eye have run this poem threw it
I am shore your pleased two no
Its letter perfect awl the weigh
My chequer tolled me sew.

Hello Mother!  Hello Father!

Here I am at Camp Granada.  Things are very entertaining,
and they say we'll have some fun when it stops raining.
< snipped >
Wait a minute!  It's stopped hailing!  Guys are swimming!
Guys are sailing!  Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

                                        Alan Sherman
/home/cis90/simben $
```

spellk

letter

Multiple arguments, spellk and letter, are passed to the cat command to process

76

cat command
viewing long text files

- Problem: The **cat** command doesn't work well for large files. The test prints so fast you will only see the end of the file. If the terminal buffer is not big enough you will not be able to scroll back to view the beginning of the file.

- For example: **cat /usr/share/doc/sudo-1.8.19p2/ChangeLog**
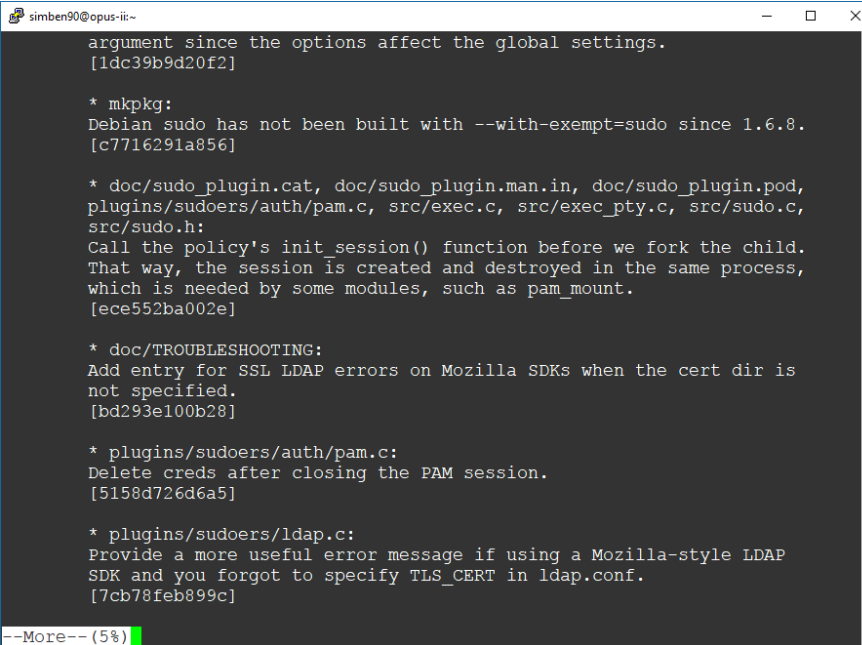
more command
viewing long text files

- Use the **more** command for scrolling through really long text files

- For example: **more /usr/share/doc/sudo-1.8.19p2/ChangeLog**

*Use the **space bar** to page forward and **q** to quit*

more command
viewing multiple text files

- The **more** command can take multiple arguments

```
/home/cis90/simben $ more spellk letter
::::::::::::::
spellk
::::::::::::::
Spell Check


Eye halve a spelling chequer
It came with my pea sea
< snipped >
Its letter perfect awl the weigh
My chequer tolled me sew.


::::::::::::::
letter
::::::::::::::
Hello Mother!  Hello Father!
< snipped >
Guys are sailing!  Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

                            Alan Sherman

/home/cis90/simben $
```

Notice with multiple files as arguments, each file has a header to separate it from the other files

less command
viewing long text files

- Use the **less** command to scroll forward and backward through really long text files. (just like the man command works)

- For example: `less /usr/share/doc/sudo-1.8.19p2/ChangeLog`

"less is more" ☺

*Use the **pg up/dn** and up/down arrows to move through text file. Use **q** to quit. For multiple arguments use **:n** and **:p** to move between multiple text files. See the man page for many more options like searching.*

80

head command
view the first lines in a text file

- Use the **head** command to show the first several lines of a file.
- Use the **-n** *<number>* option to control the number of lines printed.

```
/home/cis90/simben $ head proposal1            Print the first lines of the file proposal1
A Plan for the Improvement of English Spelling
   by Mark Twain
For example, in Year 1 that useless letter "c" would be dropped to be replased
either by "k" or "s", and likewise "x" would no longer be part of the alphabet.
The only kase in which "c" would be retained would be the "ch" formation, which
will be dealt with later. Year 2 might reform "w" spelling, so that "which" and
"one" would take the same konsonant, wile Year 3 might well abolish "y"
replasing it with "i" and Iear 4 might fiks the "g/j" anomali wonse and for all.
Jenerally, then, the improvement would kontinue iear bai iear with Iear 5 doing
awai with useless double konsonants, and Iears 6-12 or so modifaiing vowlz and
/home/cis90/simben $
```

Print the first lines of the file proposal1

```
/home/cis90/simben $ head -n 3 proposal1       Print the first 3 lines of the file proposal1
A Plan for the Improvement of English Spelling
   by Mark Twain
For example, in Year 1 that useless letter "c" would be dropped to be replased
/home/cis90/simben $
```

Print the first 3 lines of the file proposal1

81

head command
view the first lines of multiple text files

`/home/cis90/simben $ head -n2 mission letter spellk log`   *Print the first 2 lines of each of these files*

==> mission <==

                    Mission * Purpose * Values

==> letter <==

Hello Mother! Hello Father!

Note the small banners containing the filename which separates each file.

==> spellk <==

Spell Check

The second line of the first three files are blank.

==> log <==

lab01 was submitted on Wed Feb 8 16:23:35 PST 2012

lab01 was submitted on Wed Feb 8 16:58:20 PST 2012

82

tail command
view the last lines in a text file

* Use the **tail** command to show the last several lines of a file.
* Use the **-n** *<number>* option to control the number of lines printed.

```
/home/cis90/simben $ tail mission    Print the tail end of the file
       environment which aids students in their pursuit of transfer,
       career preparation, personal fulfillment, job advancement, and
       retraining goals.

       Our core values are academic freedom, critical and independent
       thinking, and respect for all people and cultures. Our commitment
       is to encourage excellence, offer a balanced curriculum, promote
       teaching methods for diverse learning styles, and involve and
       enrich our community.
```

```
/home/cis90/simben $ tail -n3 mission    Print the last 3 lines of the file
       teaching methods for diverse learning styles, and involve and
       enrich our community.
```

83

wc command
count words and lines in a text file

```
/home/cis90/simben $ wc letter
  28  182 1044 letter
```

#bytes
#words
#lines

```
/home/cis90/simben $ wc -l letter
28 letter
```
Use the -l option to count just the number of lines

```
/home/cis90/simben $ wc -w letter
182 letter
```
Use the -w option to count just the number of words

```
/home/cis90/simben $ wc letter mission proposal1
  28  182 1044 letter
  18  107  759 mission
  16  196 1074 proposal1
  62  485 2877 total
```
The wc command can take multiple arguments

Text File Activity

- In your home directory on Opus-II, print the first 3 lines of the log file:

  ```
  head -n3 log
  ```

- Review the three proposals:

  ```
  more proposal1 proposal2 proposal3
  ```

- Count the number of words in small_town:

  ```
  wc -w small_town
  ```

  Put the number of words in
  small_town into the chat window.

Text File Activity

• Print the last line of small_town:

```
tail -n1 small_town
```

• Count the number of lines in mission:

```
wc -l mission
```

• Prove and classify the following three files:

```
file mission Miscellaneous what_am_i
```

Of the three files probed which is a <u>text</u> file and meant to be viewed using one of the text file commands (e.g. cat, more, wc, ..., etc.)?

Put your answer in the chat window.

Text File Activity

- Browse bigfile is a way that you can scroll up and down through the file:

  `less bigfile`

- Count the number of characters in bigfile:

  `wc -c small_town`

- Read proposal1:

  `cat proposal1`
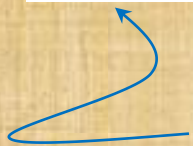
What happens if you use tac instead of cat? (tac is cat spelled backwards)
Put your answer in the chat window.

87

Viewing binary files

Viewing **binary** files:

- file *useful for identifying whether a file is text or binary*

- xxd *show the contents of a binary file as a "hex dump"*

Identifying Binary Files

binary files

```
/home/cis90/simben $ file /bin/uname what_am_i spellk bin/enlightenment
/bin/uname:        ELF 32-bit LSB executable, Intel 80386, version 1
(SYSV), dynamically linked (uses shared libs), for GNU/Linux 2.6.18,
stripped
what_am_i:         data
spellk:            ASCII English text
bin/enlightenment: POSIX shell script text executable
```

text files

*If the output of the file command does not contain
"text" then the file is most likely a binary file*

Binary Files

Binary files should not be viewed with cat, more, less, head, tail, etc.

```
/home/cis90/simben $ cat /bin/uname
ELF04`I4(444444 > >@ ( A    HHH  P td 644Q td/lib/ld-
linux.so.2GNU       (B `(* K  G- >K   y cg }Ti      w )
                         C52L /9=@  x H  ^fOI
G <      '  6?    w C*Y  A  $),K,∫ "  ),K   H . . . .
.       / d8/     </      /        sii   /  ii   w ~  w
~  w  ~  w  ~  w  ii
     )  *+, $(,08   <
```
< snipped >
```
uTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTT
YPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPuTTYPu
TTYPuTTYPuTTYPuTTY
/home/cis90/simben $
```

*Tip: Use the **reset** command to fix
terminal if it gets really "sick"*

Binary Files
Use xxd command to view

The file /bin/uname is viewed as a hex dump

E=ASCII 45 at 00000001
L=ASCII 4c at 00000002
F=ASCII 46 at 00000003

```
/home/cis90/simben $ xxd /bin/uname
0000000: 7f45 4c46 0101 0100 0000 0000 0000 0000  .ELF............
0000010: 0200 0300 0100 0000 308b 0408 3400 0000  ........0...4...
0000020: 6049 0000 0000 0000 3400 2000 0800 2800  `I......4. ...(.
0000030: 1f00 1e00 0600 0000 3400 0000 3480 0408  ........4...4...
0000040: 3480 0408 0001 0000 0001 0000 0500 0000  4...............
0000050: 0400 0000 0300 0000 3401 0000 3481 0408  ........4...4...
0000060: 3481 0408 1300 0000 1300 0000 0400 0000  4...............
0000070: 0100 0000 0100 0000 0000 0000 0080 0408  ................
< snipped >
0004df0: 0000 0000 0000 0000 d842 0000 6c05 0000  .........B..l...
0004e00: 0000 0000 0000 0000 0400 0000 0100 0000  ................
0004e10: 0100 0000 0300 0000 0000 0000 0000 0000  ................
0004e20: 4448 0000 1901 0000 0000 0000 0000 0000  DH..............
0004e30: 0100 0000 0000 0000                       ........
/home/cis90/simben $
```

Hexadecimal offsets into the file

The printable "ELF" above is located between hex offsets **00000000** *and* **00000010** *shown on the left column*

92

Binary File Activity

Where is the hostname command?

type hostname

What kind of file is the hostname command?

file /usr/bin/hostname

Try to cat the hostname command:

cat /usr/bin/hostname

Do a hex dump of the hostname command:

xxd /usr/bin/hostname

What text string is found at hex offset 242-246 of /usr/bin/hostname? Put your answer in the chat window.

93

Basic file types

(according to the filesystem)

Understanding a Long Listing

The -l option on the ls command produces a "long listing" that shows more information

```
/home/cis90/simben $ ls -l letter
-rw-r--r--. 1 simben90 cis90 1044 Jul 20  2001 letter
```

permissions

owner (the username that owns the file)

group

size (in bytes)

modification date

filename

number of hard links
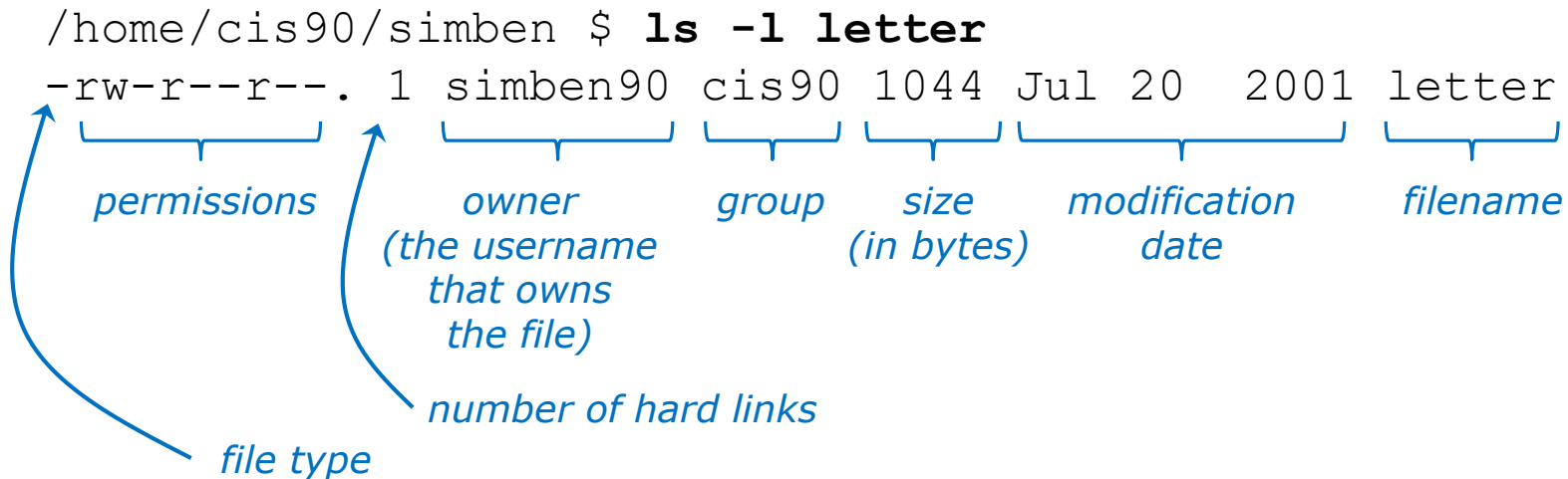
file type

Except for the filename "letter", all other information shown above is stored in the file's inode

95

Filesystem File Types

Column 1 of long listing	Type		How to make one
d	**Directory**		mkdir
-	**Regular** • Programs • Text • Data (binary) • Many more …	*Use the **file** command to further classify regular files*	touch vi >
l	**Symbolic link**		ln -s
c	**Character special device**		mknod
b	**Block special device**		mknod

- Every file has a specific type attribute which is stored in the inode.

- File types can be viewed in <u>column 1</u> of **long listings**.

96

"-" Regular Files

```
ls -l
```

```
simben90@opus-ii:~                                        —    □    ×

/home/cis90/simben $ ls -l
total 92
-rw-r--r--. 2 simben90 cis90 10576 Jul 20  2001 bigfile
drwxr-xr-x. 2 simben90 cis90   109 Aug 13  2017 bin
-rw-r--r--. 1 simben90 cis90     0 Jul 20  2001 empty
d---------. 2 simben90 cis90    36 Feb  1  2002 Hidden
-rw-r--r--. 1 simben90 cis90   373 Jan 31 12:04 lab01-collection
-rw-r--r--. 1 simben90 cis90  5241 Feb 15 13:33 lab02-collection
-rw-------. 1 simben90 cis90  1221 Feb 18 09:25 lab04-mydata
drwxr-xr-x. 2 simben90 cis90   184 Feb 17  2001 Lab2.0
drwxr-xr-x. 3 simben90 cis90   130 Feb 17  2001 Lab2.1
-rw-r--r--. 1 simben90 cis90  1044 Jul 20  2001 letter
-rw-r--r--. 1 simben90 cis90   364 Feb 18 09:26 log
drwxr-xr-x. 2 simben90 cis90    97 Sep 11  2005 Miscellaneous
-rw-r--r--. 1 simben90 cis90   759 Jun  6  2002 mission
drwxr-xr-x. 8 simben90 cis90   138 Aug  6  2014 Poems
-rw-r--r--. 1 simben90 cis90  1074 Aug 26  2003 proposal1
-rw-r--r--. 1 simben90 cis90  2175 Jul 20  2001 proposal2
-rw-r--r--. 1 simben90 cis90  2054 Sep 14  2003 proposal3
-rw-r--r--. 1 simben90 cis90  1580 Nov 16  2004 small_town
-rw-r--r--. 1 simben90 cis90   485 Aug 26  2003 spellk
-rw-r--r--. 1 simben90 cis90   250 Jul 20  2001 text.err
-rw-r--r--. 1 simben90 cis90   231 Jul 20  2001 text.fxd
-rwxr-xr-x. 1 simben90 cis90   519 Aug  6  2014 timecal
-rw-rw-r--. 1 simben90 cis90  2265 Feb 14 17:12 trash
-rw-rw-r--. 1 simben90 cis90 10297 Feb 18 08:05 uhistory
-rw-r--r--. 1 simben90 cis90   352 Jul 20  2001 what_am_i
/home/cis90/simben $
```

column 1

"Total 92" indicates directory is using 92 data blocks

sudo blockdev --getbsz /dev/sda1
sudo blockdev --getbsz /dev/sda2

*The **regular** files are highlighted above. Note they each have a dash "-" in column one and the filenames are not colored.*

97

"l" Symbolic Links

`ls -l /`

```
/home/cis90/simben $ ls -l /
total 24
lrwxrwxrwx.   1 root root    7 Aug  4  2017 bin -> usr/bin
dr-xr-xr-x.   5 root root 4096 Jan 21 09:21 boot
drwxr-xr-x.  19 root root 3240 Jan 21 09:20 dev
drwxr-xr-x. 102 root root 8192 Feb 15 14:27 etc
drwxr-xr-x.  12 root root  148 Jan  7 17:24 home
lrwxrwxrwx.   1 root root    7 Aug  4  2017 lib -> usr/lib
lrwxrwxrwx.   1 root root    9 Aug  4  2017 lib64 -> usr/lib64
drwxr-xr-x.   2 root root    6 Nov  5  2016 media
drwxr-xr-x.   2 root root    6 Nov  5  2016 mnt
drwxr-xr-x.   2 root root    6 Nov  5  2016 opt
dr-xr-xr-x. 225 root root    0 Jan 21 09:20 proc
dr-xr-x---.   6 root root 4096 Feb  1 17:21 root
drwxr-xr-x.  34 root root 1000 Jan 21 09:21 run
lrwxrwxrwx.   1 root root    8 Aug  4  2017 sbin -> usr/sbin
drwxr-xr-x.   2 root root    6 Nov  5  2016 srv
dr-xr-xr-x.  13 root root    0 Jan 21 09:20 sys
drwxrwxrwt.  13 root root 4096 Feb 18 15:00 tmp
drwxr-xr-x.  13 root root  155 Aug  4  2017 usr
drwxr-xr-x.  20 root root  278 Aug 13  2017 var
/home/cis90/simben $
```

column 1

*The **symbolic link** files are highlighted above. Note they each have the letter "l" in column one and an arrow "->"pointing to the linked file.*

98

"d" directories

`ls -l /`

```
simben90@opus-ii:~                                              —    □    ✕

/home/cis90/simben $ ls -l /
total 24
lrwxrwxrwx.   1 root root    7 Aug  4  2017 bin -> usr/bin
dr-xr-xr-x.   5 root root 4096 Jan 21 09:21 boot
drwxr-xr-x.  19 root root 3240 Jan 21 09:20 dev
drwxr-xr-x. 102 root root 8192 Feb 15 14:27 etc
drwxr-xr-x.  12 root root  148 Jan  7 17:24 home
lrwxrwxrwx.   1 root root    7 Aug  4  2017 lib -> usr/lib
lrwxrwxrwx.   1 root root    9 Aug  4  2017 lib64 -> usr/lib64
drwxr-xr-x.   2 root root    6 Nov  5  2016 media
drwxr-xr-x.   2 root root    6 Nov  5  2016 mnt
drwxr-xr-x.   2 root root    6 Nov  5  2016 opt
dr-xr-xr-x. 225 root root    0 Jan 21 09:20 proc
dr-xr-x---.   6 root root 4096 Feb  1 17:21 root
drwxr-xr-x.  34 root root 1000 Jan 21 09:21 run
lrwxrwxrwx.   1 root root    8 Aug  4  2017 sbin -> usr/sbin
drwxr-xr-x.   2 root root    6 Nov  5  2016 srv
dr-xr-xr-x.  13 root root    0 Jan 21 09:20 sys
drwxrwxrwt.  13 root root 4096 Feb 18 15:00 tmp
drwxr-xr-x.  13 root root  155 Aug  4  2017 usr
drwxr-xr-x.  20 root root  278 Aug 13  2017 var
/home/cis90/simben $ ▮
```

column 1

*The **directories** are highlighted above. Note they each have the letter "d" in column one and the names are blue.*

99

"b" block and "c" character devices

```
ls -l /dev/sda
ls -l /dev/sda1
ls -l /dev/tty1
ls -l /dev/pts/4
```

```
simben90@opus-ii:~                                                    —    □    ×
/home/cis90/simben $
/home/cis90/simben $ ls -l /dev/sda
brw-rw----. 1 root disk 8, 0 Aug 31 12:23 /dev/sda
/home/cis90/simben $
/home/cis90/simben $ ls -l /dev/sda1
brw-rw----. 1 root disk 8, 1 Aug 31 12:23 /dev/sda1
/home/cis90/simben $
/home/cis90/simben $ ls -l /dev/tty1
crw--w----. 1 root tty 4, 1 Aug 31 12:23 /dev/tty1
/home/cis90/simben $
/home/cis90/simben $ ls -l /dev/pts/4
crw--w----. 1 simben90 tty 136, 4 Sep 18 12:25 /dev/pts/4
/home/cis90/simben $
```
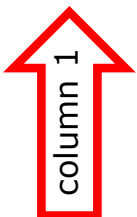
↑ column 1

The first SCSI hard drive (/dev/sda) and the first partition on the first ASCSI hard drive are block devices with a "b" in column 1.

The first tty terminal (/dev/tty1) and the fourth pseudo terminal (/dev/pts/4) are character devices with a "c" in column 1.

100

Activity

Do a long listing of the system /boot directory:

`ls -l /boot`

• Is *grub* a directory or a regular file?

• Is *vmlinuz-3.10.0-693.11.6.el7.x86_64* a directory or a regular file?

Write your answers in the chat window

Activity

Do a long listing of your Miscellaneous directory:

`ls -l Miscellaneous/`

• Which file is a symbolic link file?

• What file does the symbolic link file reference?

Write your answers in the chat window

Further classification of files

(according to the file command)

file command
Provides expanded information about files

- There are many different types of regular files:
  - Programs (binary)
  - Scripts (text)
  - Text files
  - Data files (binary)

- The **file** command attempts to classify files and give you more detailed information on the file contents.

*Tip: Use the **file** command to determine if a file is a text file and can be viewed with **cat**, **more**, **less**, **tail** … etc commands.*

file command
Examples

Use the **file** command to determine if a regular file is text or binary

letter and /bin/uname are both regular files

```
/home/cis90/simben $ ls -l letter  /bin/uname
-rwxr-xr-x. 1 root      root  26004 Dec  7  2011 /bin/uname
-rw-r--r--. 1 simben90 cis90  1044 Jul 20  2001 letter
```

```
/home/cis90/simben $ file letter
letter: ASCII English text
/home/cis90/simben $
```

The data portion of the letter file is text and can be viewed by cat, more, head, etc.

```
/home/cis90/simben $ file /bin/uname
/bin/uname: ELF 32-bit LSB executable, Intel 80386, version 1
(SYSV), for GNU/Linux 2.6.9, dynamically linked (uses shared
libs), for GNU/Linux 2.6.9, stripped
/home/cis90/simben $
```

The data portion of the /bin/uname file is binary and can be viewed with the xxd command

109

Using **file** command to further classify files

Long listings show basic file types in column 1 "-"=regular file "d"=directory

```
/home/cis90/depot/filetypes $ ls -l
total 108
-rw-r--r--. 1 rsimms cis90  8983 Aug  1 18:49 Adjective.frm
-rw-r--r--. 1 rsimms cis90  5976 Aug  1 18:49 Adjective.MYD
-rw-r--r--. 1 rsimms cis90  2048 Aug  1 18:49 Adjective.MYI
-rw-r--r--. 1 rsimms cis90 10240 Aug  1 18:49 backup.tar
-rw-r-----. 1 rsimms cis90   191 Aug  1 18:49 bash_profile
-rwxr-----. 1 rsimms cis90  4846 Aug  1 18:49 cprog
-rwxr-----. 1 rsimms cis90  4846 Aug  1 18:49 go-cprog
-rw-r--r--. 1 rsimms cis90   119 Aug  1 18:49 letter
-rw-r-----. 1 rsimms cis90  2968 Aug  1 18:49 mbox
-rw-r--r--. 1 rsimms cis90 34611 Aug  1 18:49 rich-260x216.jpg
-rwxr-xr-x. 1 rsimms cis90   445 Aug  1 18:49 runit
drwxr-xr-x. 2 rsimms cis90  4096 Aug  1 18:40 travel
```

Output from the file command provides additional file classification information

```
/home/cis90/depot/filetypes $ file *
Adjective.frm:    MySQL table definition file Version 9
Adjective.MYD:    DBase 3 data file (33517822 records)
Adjective.MYI:    MySQL MISAM compressed data file Version 1
backup.tar:       POSIX tar archive (GNU)
bash_profile:     ASCII English text
cprog:            ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV),
dynamically linked (uses shared libs), for GNU/Linux 2.2.5, not stripped
go-cprog:         ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV),
dynamically linked (uses shared libs), for GNU/Linux 2.2.5, not stripped
letter:           ASCII English text
mbox:             ASCII mail text
rich-260x216.jpg: JPEG image data, JFIF standard 1.02
runit:            POSIX shell script text executable
travel:           directory
```

110

Class Activity

Classify the following these files in your home directory:
- uhistory
- letter
- Poems
- timecal

- Which is a bash script?

Write your answer in the chat window

Class Activity

Classify the files in /boot

• Which are Linux kernel files?

Write your answer in the chat window

Pathnames

The need for pathnames

Question: How can we unambiguously specify any file or directory in the file tree?
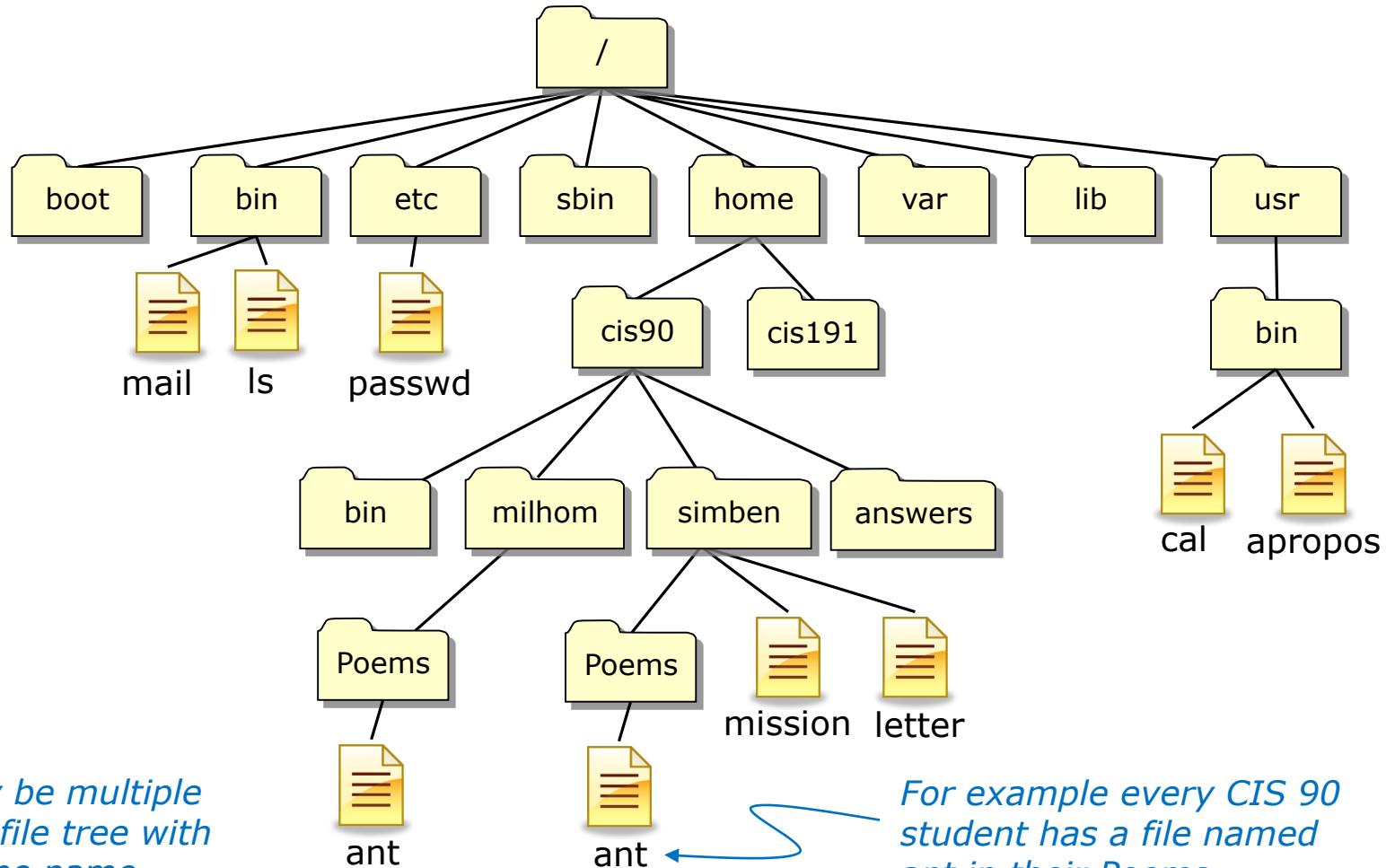
There may be multiple files in the file tree with the same name.

For example every CIS 90 student has a file named ant in their Poems directory

114

The need for pathnames

Answer: We use **absolute** or **relative pathnames**

This is Benji's ant file

115
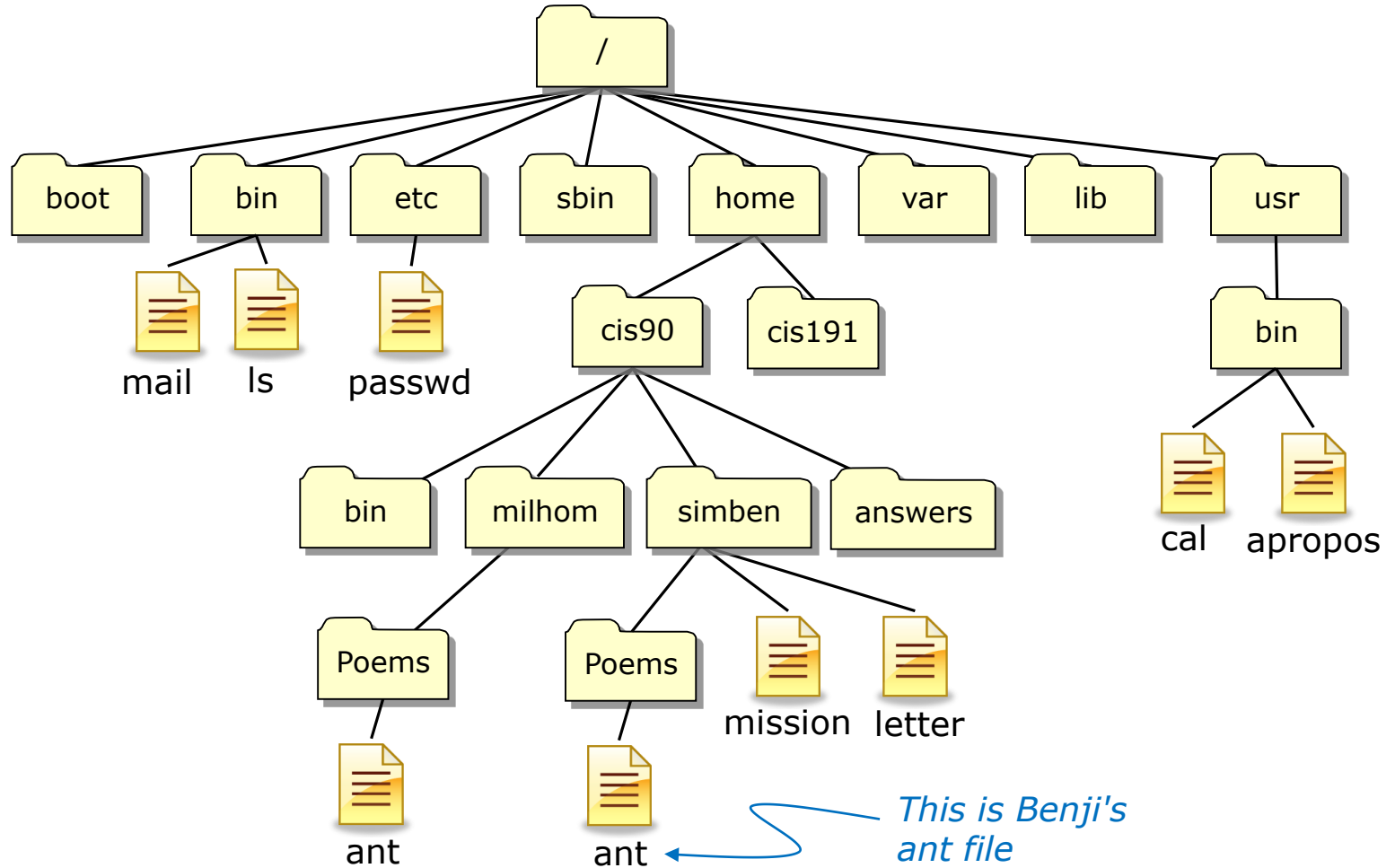
Pathnames
What the heck are they?

A pathname is a precise way to specify exactly any file or directory in the file tree.

- An **absolute pathname** specifies the path from the top of the tree to the target directory or file.

- A **relative pathname** specifies the path from your current location to the target directory or file.

Understanding pathnames is critical because they are used as arguments on all commands that deal with files and directories.

116

Absolute Pathnames

Absolute Pathnames

An **absolute pathname** specifies the path from the top of the tree to the target directory or file.

Examples:

/home/cis90/simben/Poems/ant   *(file)*

/boot   *(directory)*

/usr/bin/cal   *(file)*

/home/cis90/bin/   *(directory)*

/bin/mail   *(file)*
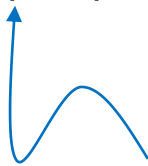
*** Important ***
Notice all absolute pathnames start
with a / (forward slash) which
represents the top of the file tree

118

Example Absolute Pathname

An **absolute pathname** specifies the path from the top of the tree to the target directory or file.

/home/cis90/simben/Poems/ant
(the absolute pathname to this specific file named ant)

119
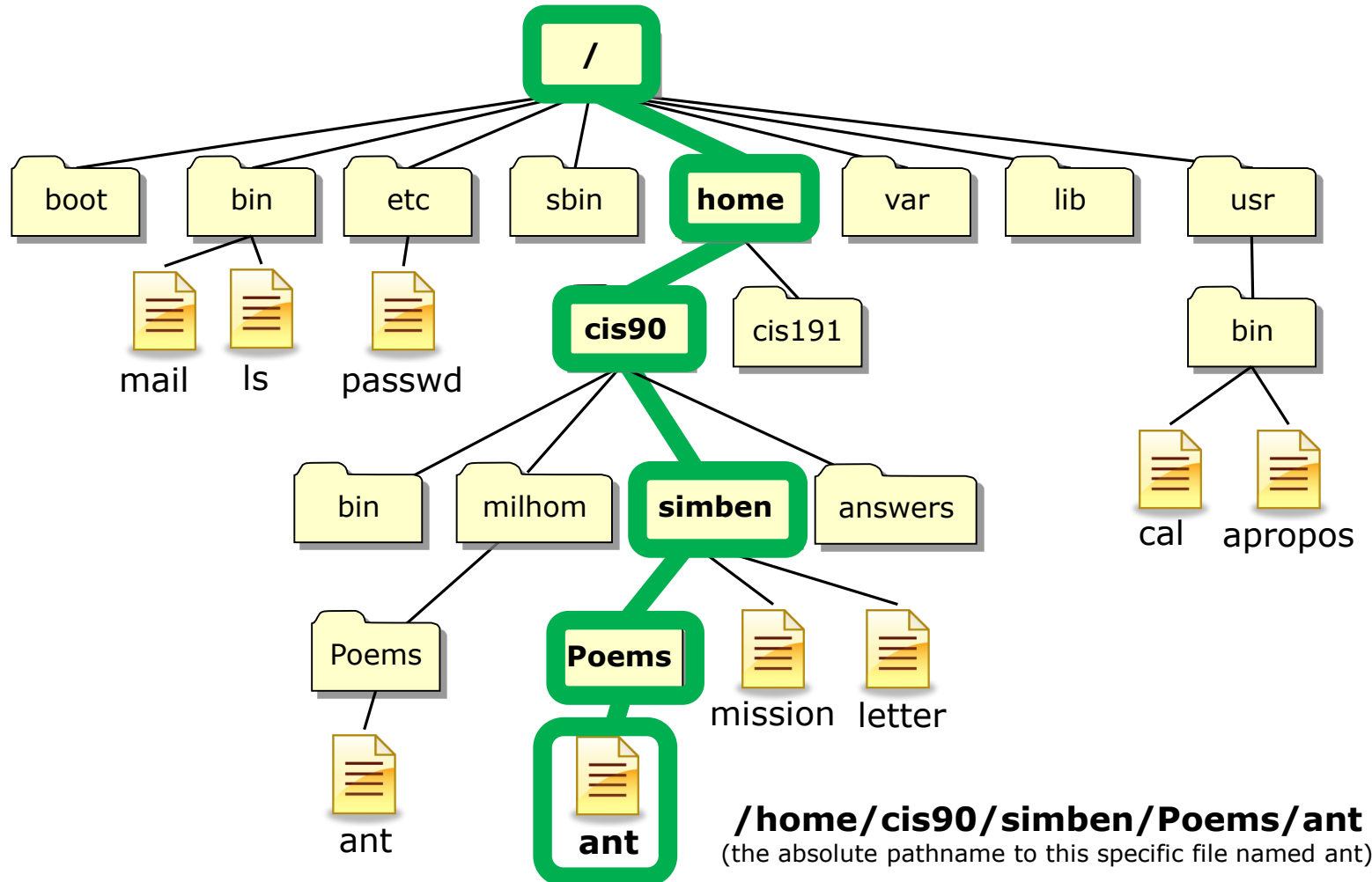
Absolute Pathname Analogy

Where is Watsonville Airport using latitude and longitude?

An analogy …

http://www.engineeringtoolbox.com/
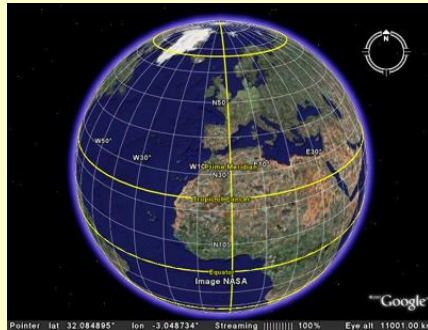
Latitude is measured in degrees north or south of the equator.
Longitude is measured in degrees east or west of the prime meridian.

Watsonville Airport
Latitude: 36-56'09" N
Longitude: 121-47'23" W
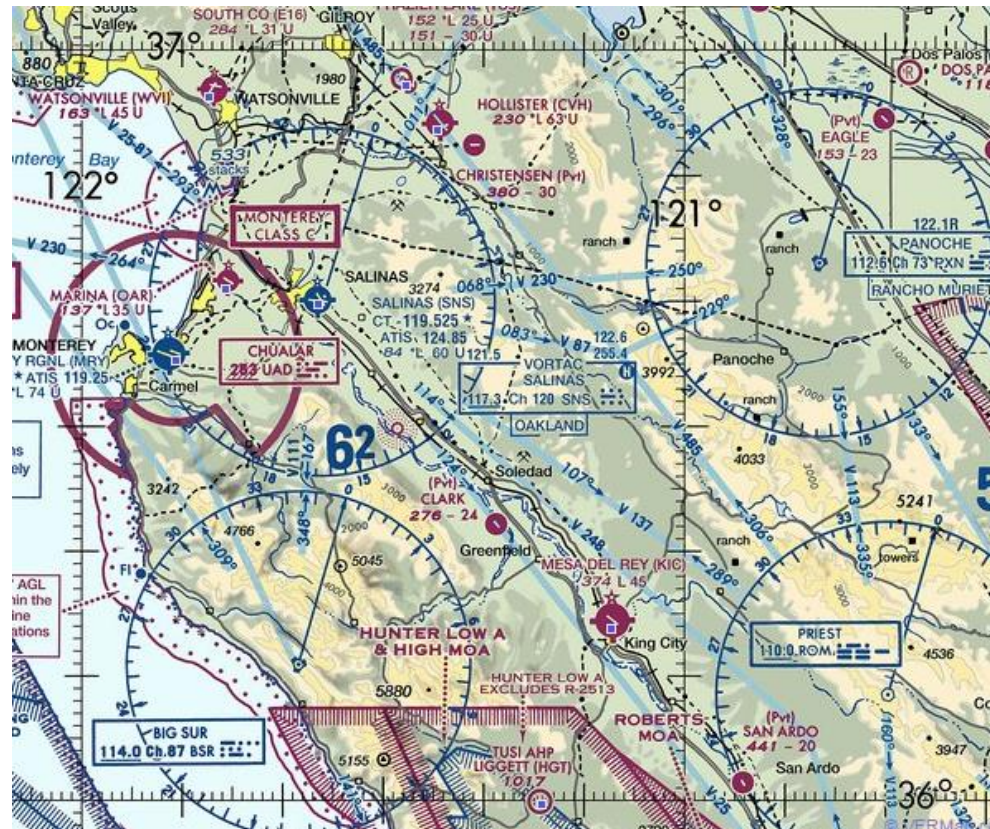
Latitude and longitude designate a target destination independent of your current location

120

Class Activity - absolute pathnames

Show the last two lines of your ant file using an absolute pathname

```
/home/cis90/simben $ tail -n2 /home/cis90/simben/Poems/ant
'till one who seemed the least
of all absorbed my whole of mind.
```

replace with your own home directory name

Show the last two lines of Homer's ant file using an absolute pathname

```
/home/cis90/simben $ tail -n2 /home/cis90/milhom/Poems/ant
'till one who seemed the least
of all absorbed my whole of mind.
```

Show the last two lines of your ant file using a variable for part of an absolute pathname

```
/home/cis90/simben $ echo $HOME/Poems/ant
/home/cis90/simben/Poems/ant
/home/cis90/simben $ tail -n2 $HOME/Poems/ant
'till one who seemed the least
of all absorbed my whole of mind.
```

Absolute Pathnames

Some more example absolute pathnames

122
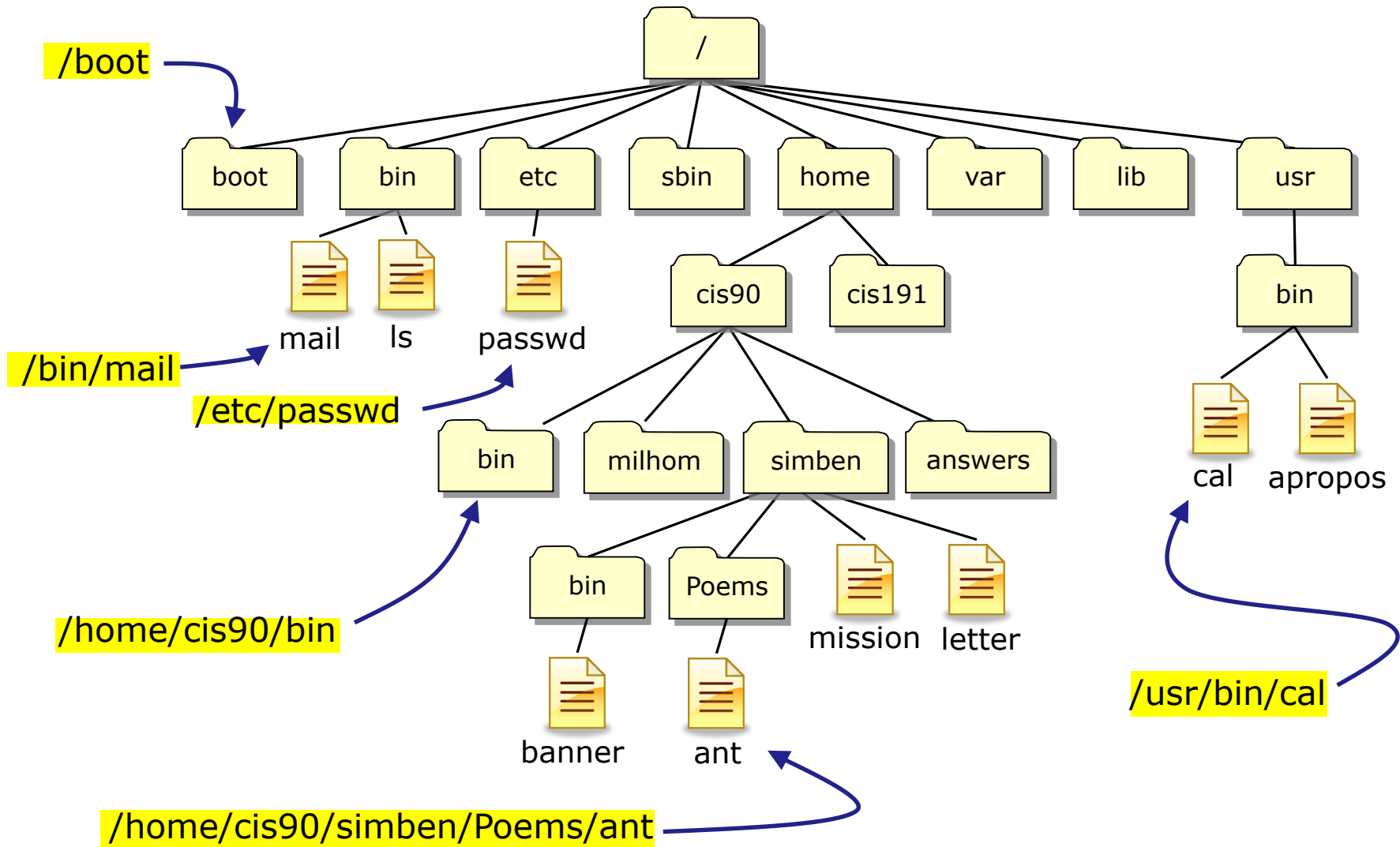
Absolute Pathnames

Some example absolute pathnames being used as arguments

```
ls   /bin /sbin /usr/bin /usr/sbin

file   /usr/bin/cal

cd  /home/cis90/simben/Poems/Shakespeare

tail   -n1   /etc/passwd

more   /home/cis90/simben/bigfile
```

*** Important ***
Notice all absolute pathnames start
with a / (forward slash) which
represents the top of the file tree

123

Activity - identify an absolute pathname

Question: what is the absolute pathname to Benji's banner file?

(write your answer in the chat window)

124
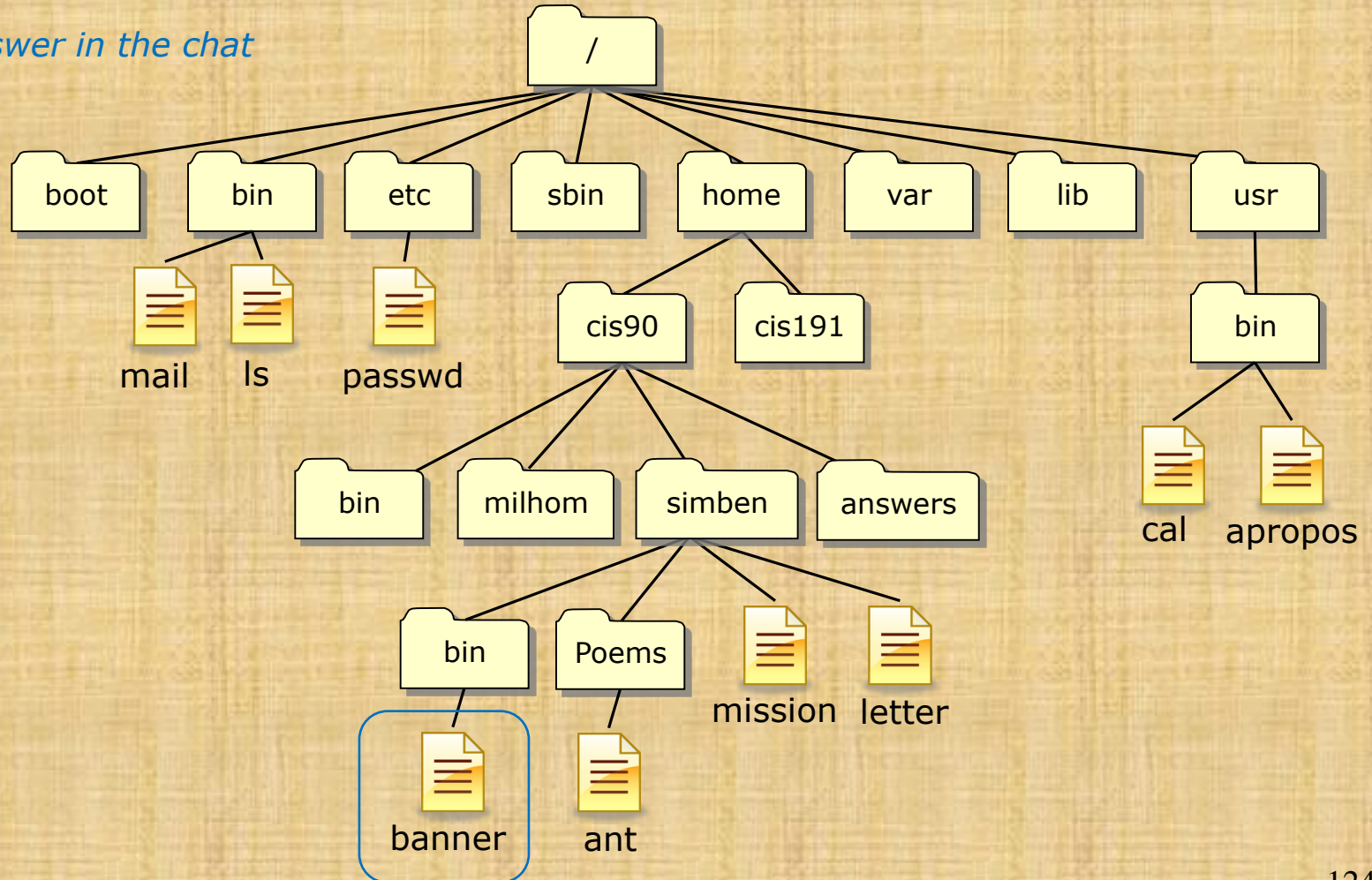
Question: what is the absolute pathname to Benji's banner file?

Answer:
/home/cis90/simben/bin/banner

125
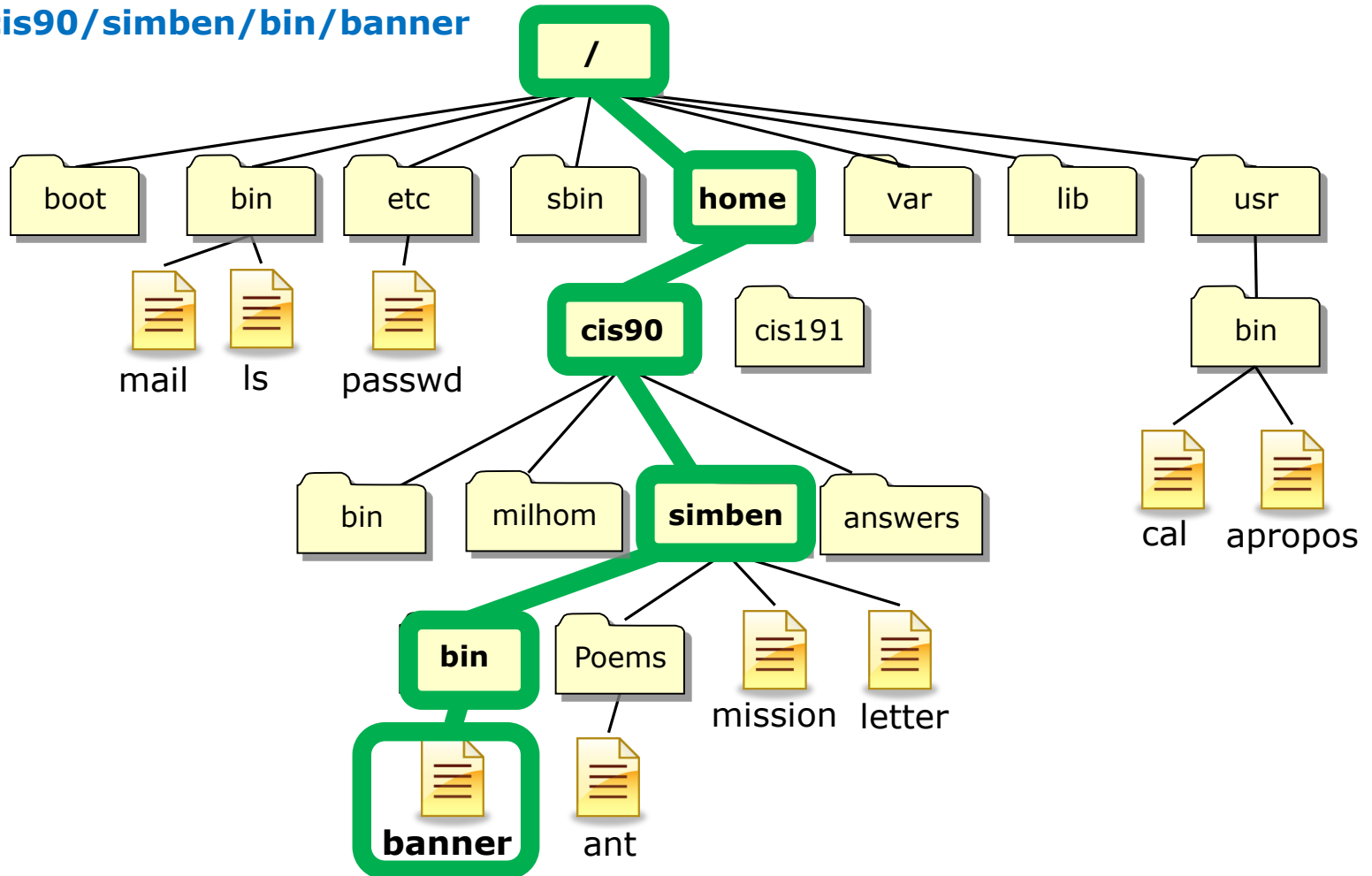
/home/cis90/simben/bin/banner

Translation of this absolute pathname in English:
Start at the top of the tree and descend into the *home*
directory, then descend into the *cis90* directory, then
descend into the *simben* directory, then descend into the
bin directory, there you will find the *banner* file.

Relative Pathnames

Relative Pathnames

*A **relative pathname** specifies the path from your current directory to the target directory or file.*

Examples:

ant   *(file)*

Poems/Shakespeare/sonnet5   *(file)*

../mission   *(file)*

../bin/   *(directory)*

../../../boot/vmlinuz-2.6.18-164.el5   *(file)*

*** Important ***
Note that relative pathnames do NOT start with a /

Relative Pathname Analogy

How do I get from Cabrillo College to Watsonville Airport using Google Maps?

An analogy …
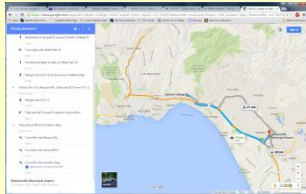
Google Maps show a driving route from your current location to a target destination

Google Maps instructions to a target destination depend on your starting location.

129

Relative Pathnames

A **relative** pathname specifies a path from our current location in the tree all the way to the specific file.

Poems/ant
(the relative pathname from Benji's home directory)

130

Relative Pathnames

A **relative** pathname specifies a path from our current location in the tree all the way to the specific file.

This .. means "go up to the parent directory"

../simben/Poems/ant
(the relative pathname from Homer's home directory)

131
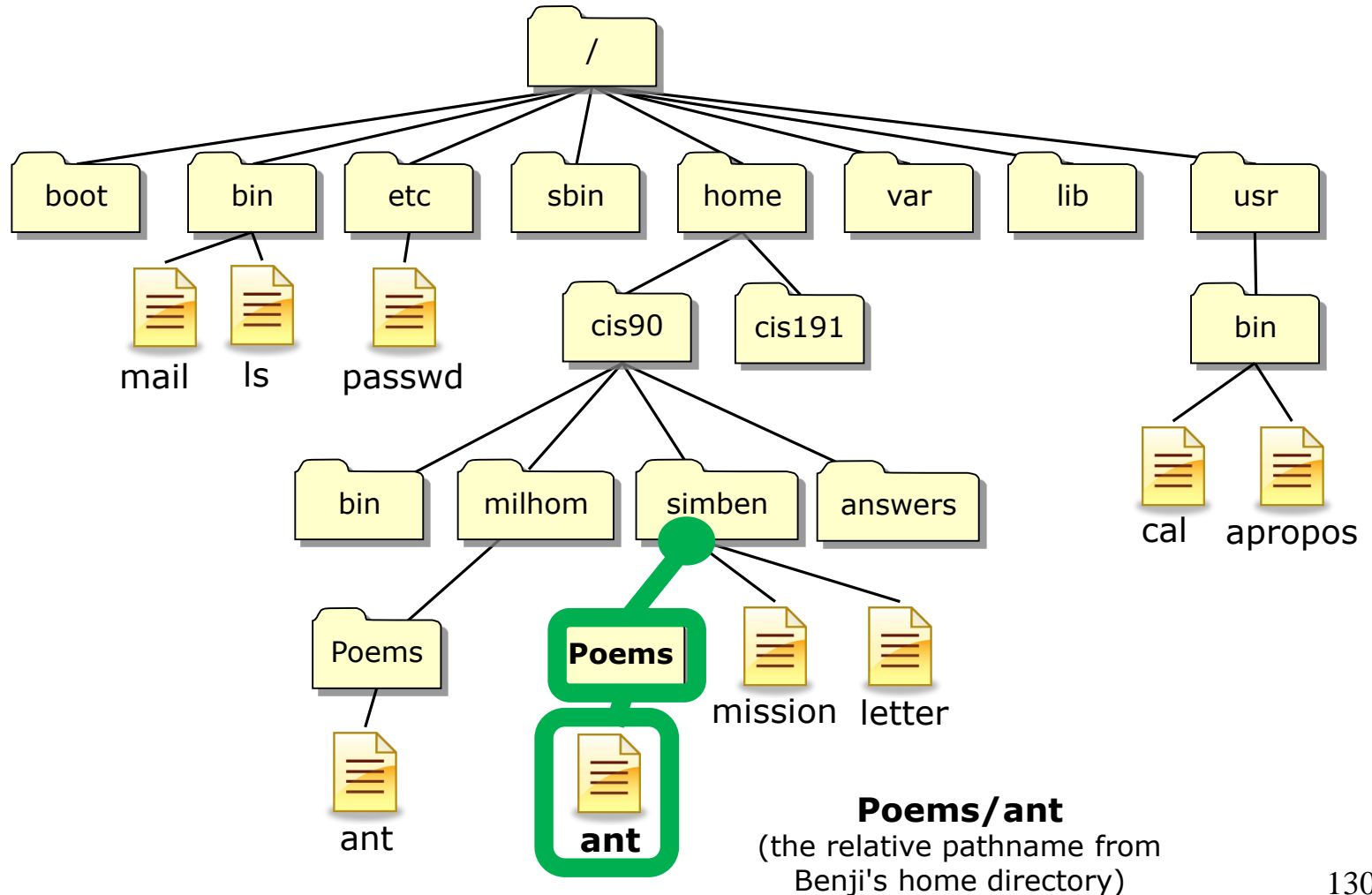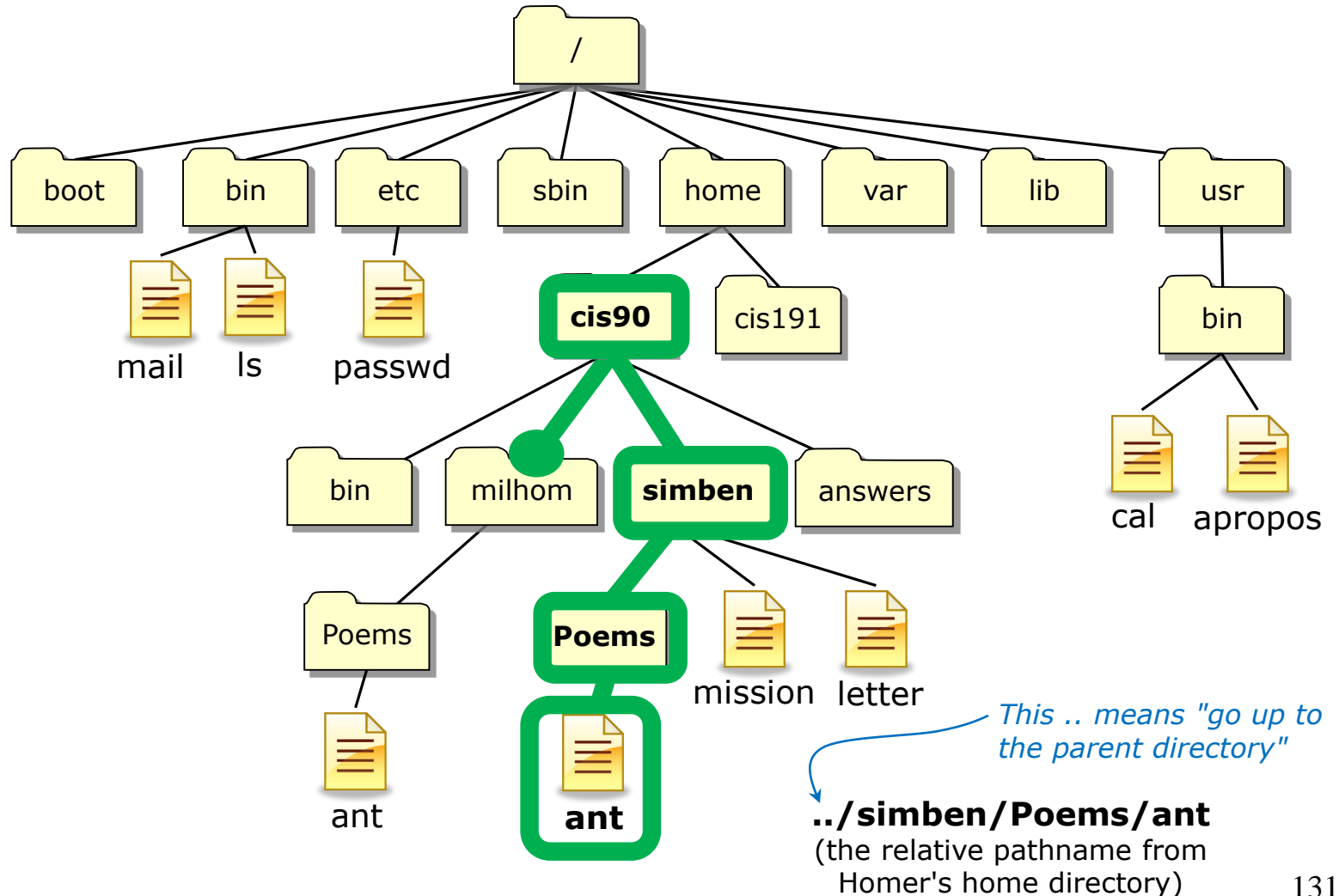
Class Activity - relative pathnames

Show the first three lines of your ant file using a relative pathname

```
/home/cis90/simben $ cd
/home/cis90/simben $ head -n3 Poems/ant
        Death of an Ant

With a magnifying glass
```

Go to your home directory if you are not already there

Show the first three lines of Homer's ant file using a relative pathname

```
/home/cis90/simben $ head -n3 ../milhom/Poems/ant
        Death of an Ant

With a magnifying glass
```

.. *means to go up one level in the tree to the parent directory of the current working directory*

Show the first three lines of your Shakespeare sonnet5 file

```
/home/cis90/simben $ head -n3 Poems/Shakespeare/sonnet5
Those hours that with gentle work did frame
The lovely gaze where every eye doth dwell
Will play the tyrants to the very same,
```

132

Relative Pathnames
Using relative pathnames as command arguments

Examples of using relative pathnames as command arguments:

ls -l ant

file ../../../../bin/mail

cd Poems/Blake

head ../bin/check3

The .. is used to represent the parent directory

file Poems/Shakespeare/sonnet4

cd Poems/Shakespeare

*** Important ***
Notice that these pathnames do NOT start with the /
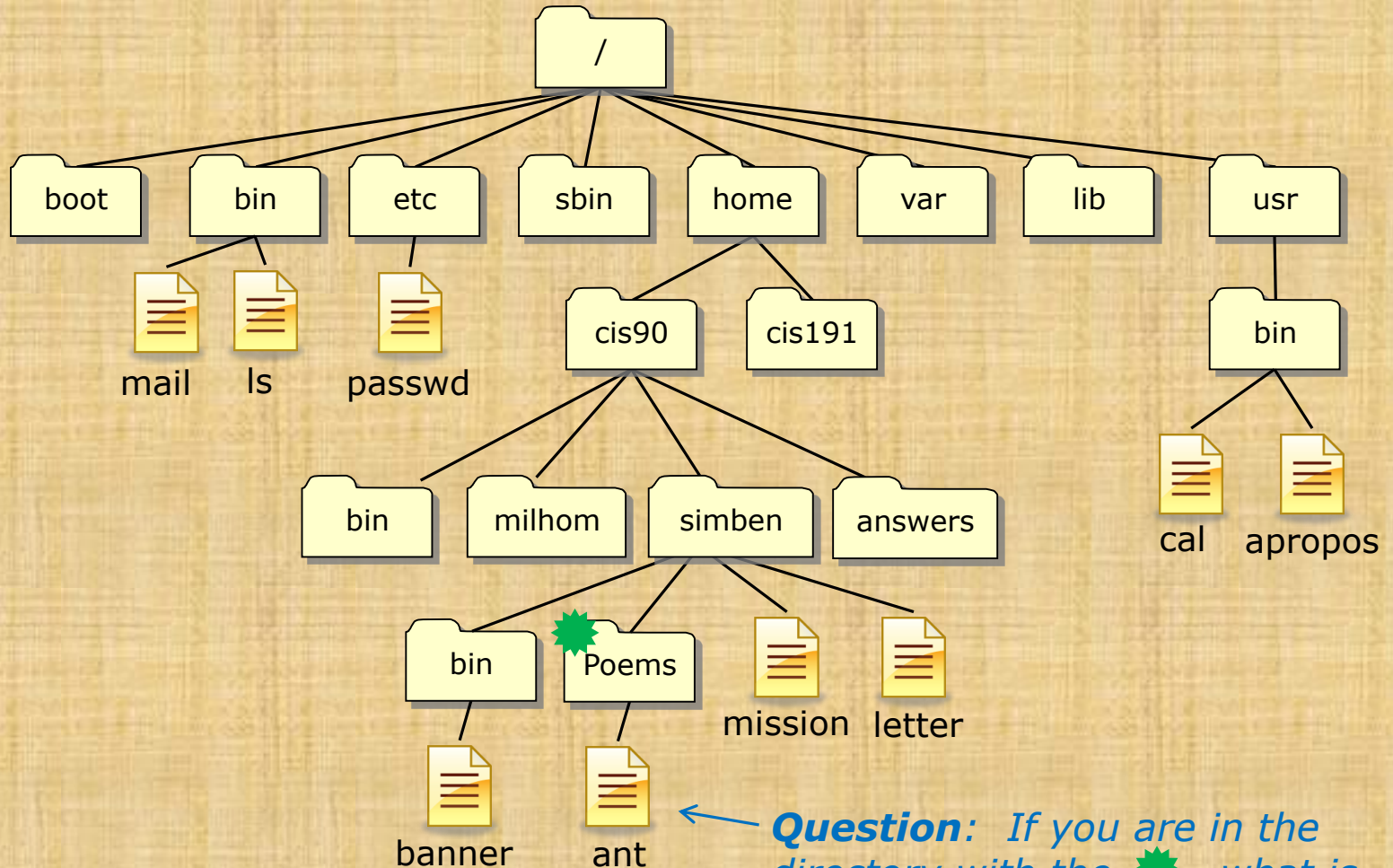
133

Activity - identify a relative pathname

Question: *If you are in the directory with the ✸ , what is the relative path to this file?*

134

Answer: the relative
path to this file is: **ant**

135

Activity - identify a relative pathname

Question: If you are in the directory with the ✦, what is the relative path to this file?

136
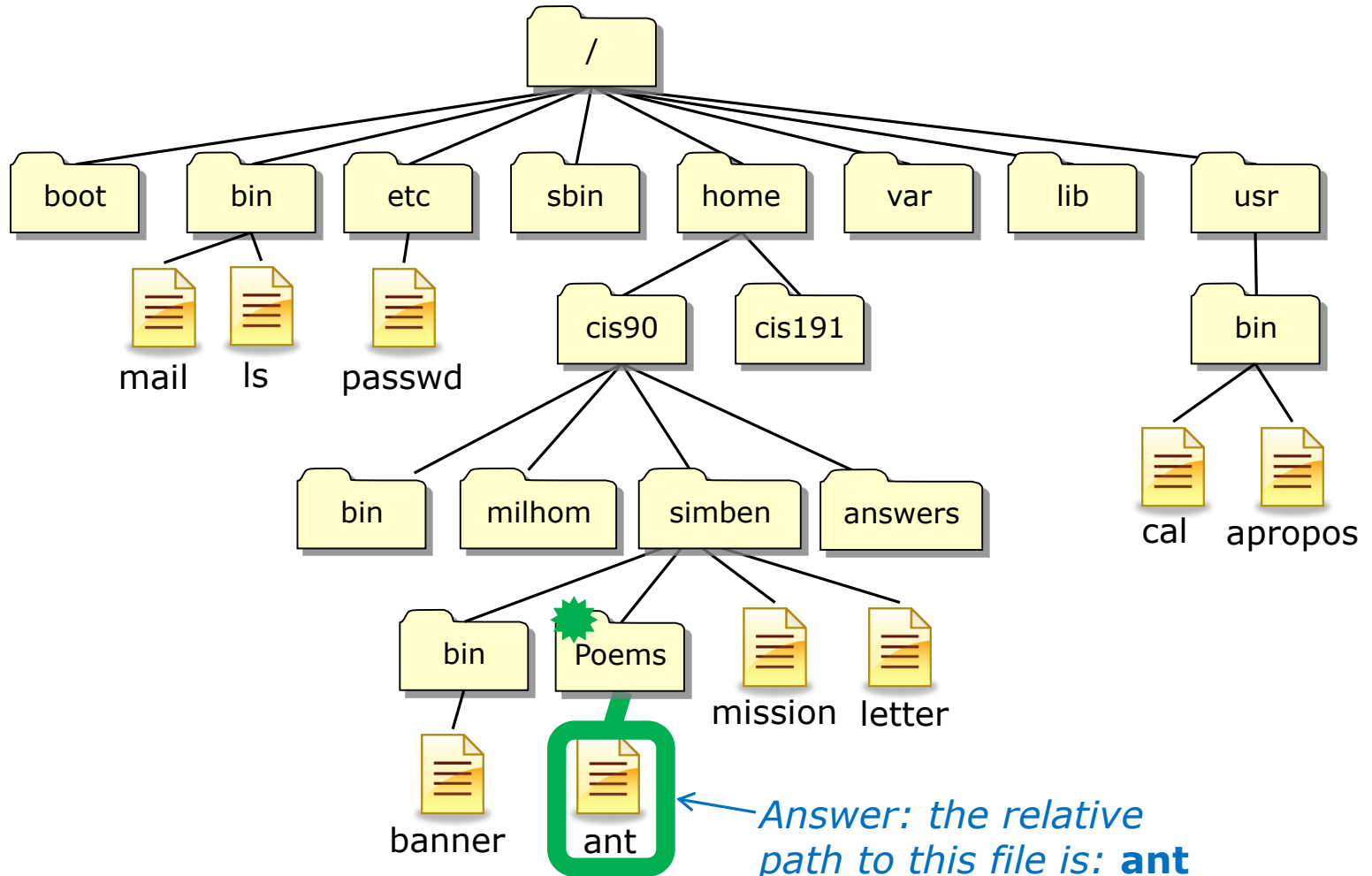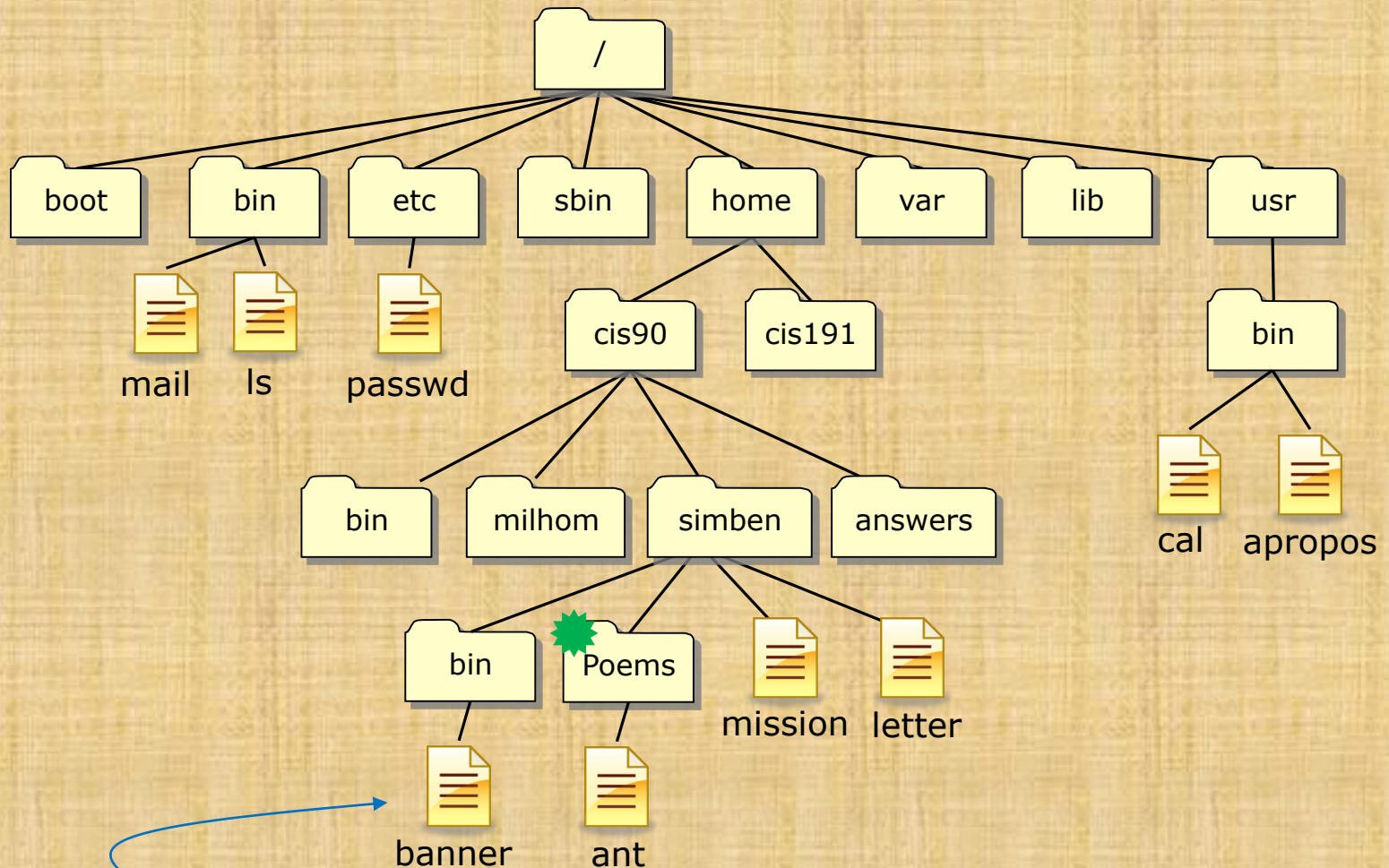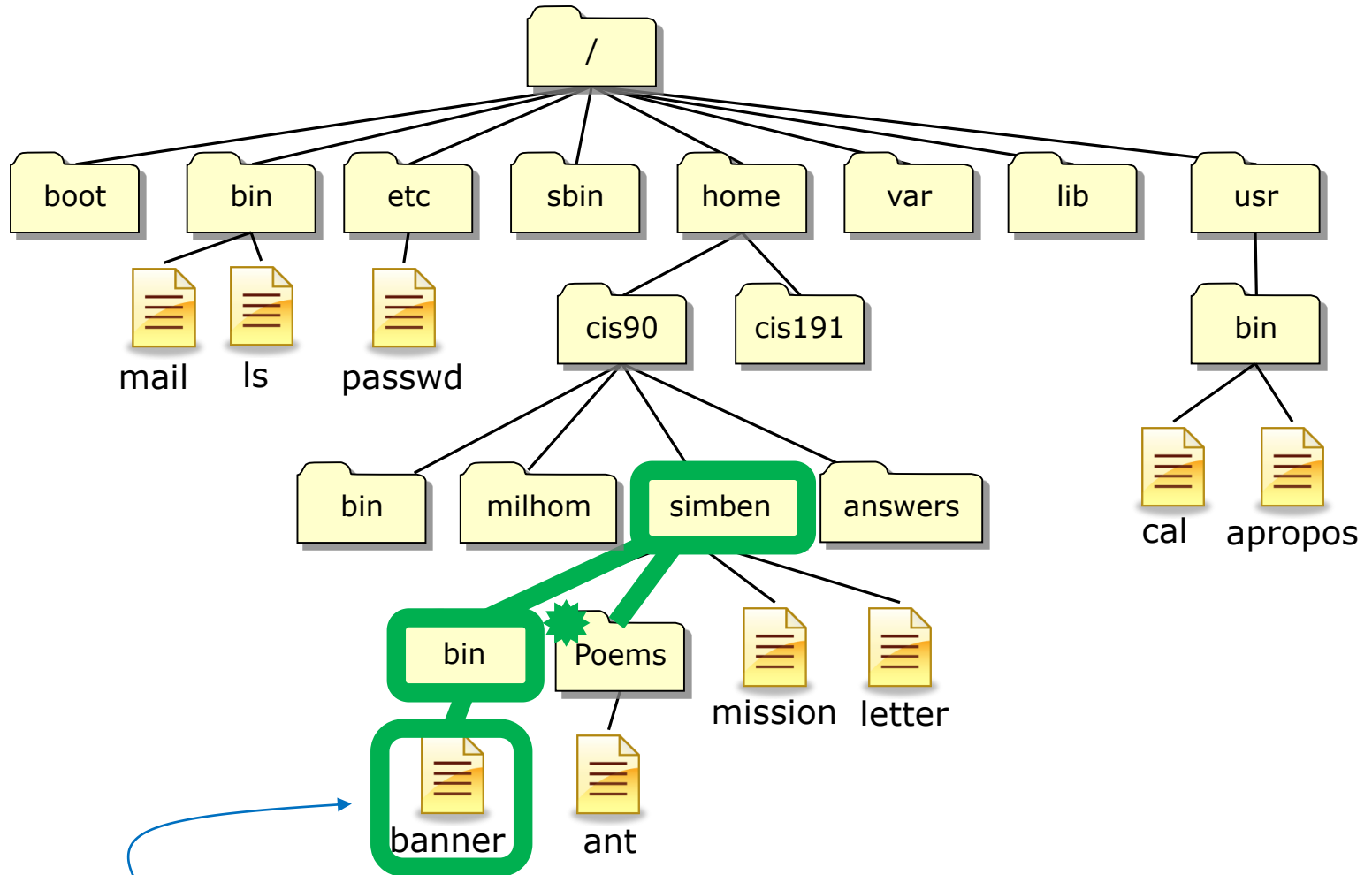
Answer: The relative path to this file is: **../bin/banner**

../bin/banner

Translation of this relative pathname in English:
Starting in your current directory, go up one level to the parent directory, then descend into the *bin* directory, there you will find the *banner* file.

Some example relative pathnames (from the directory marked with a ✳)

139

Some example relative pathnames (from the directory marked with a ✹)

140
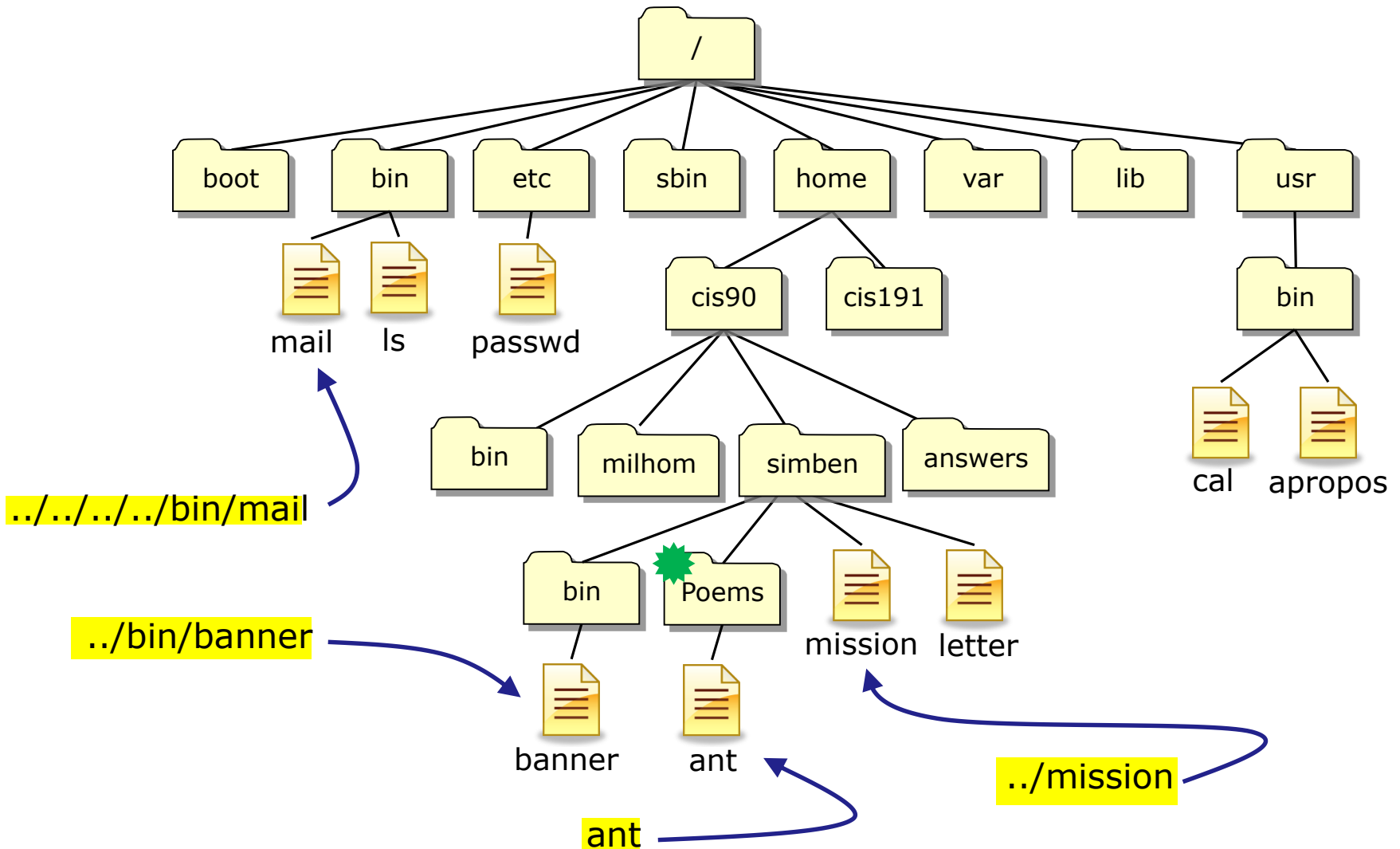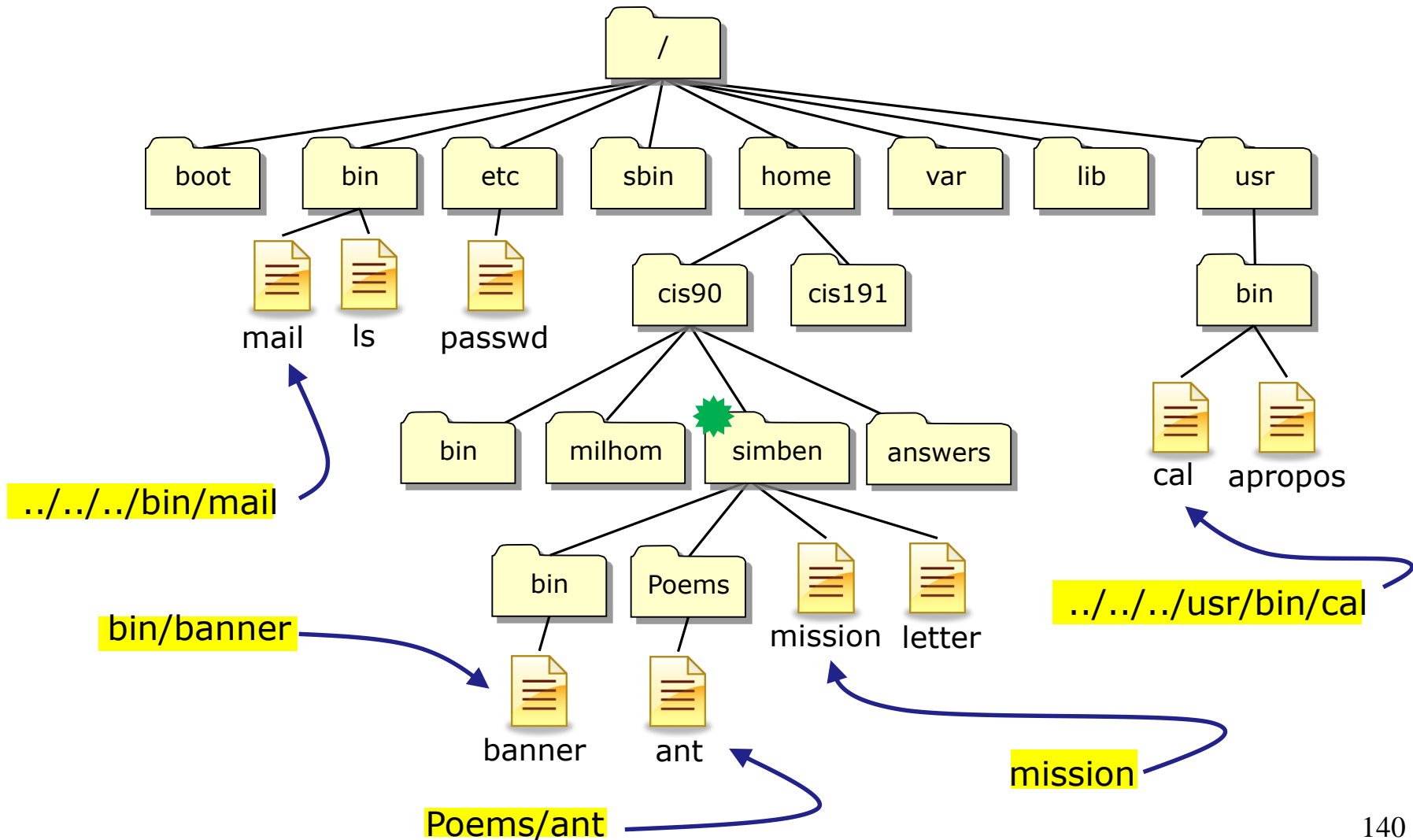
Class Exercise

From your home directory:

- List the */etc/passwd* file using a relative pathname

  ```
  /home/cis90/simben $ ls -l ../../../etc/passwd

  -rw-r--r--. 1 root root 10162 Feb 18 09:26 ../../../etc/passwd
  ```

- List the */etc/passwd* file using a absolute pathname

  ```
  /home/cis90/simben $ ls -l /etc/passwd

  -rw-r--r--. 1 root root 10162 Feb 18 09:26 /etc/passwd
  ```

*Sometimes it's easier to specify a
filename using an absolute pathname*

141

Heads up on a future test question

Question:
What is the absolute pathname of /etc/passwd?

Answer:
/etc/passwd

What is the color of Washington's white horse?

Question: What is the absolute pathname of /etc/passwd?

Answer: /etc/passwd

/

.

. .

~

/ .. . ~
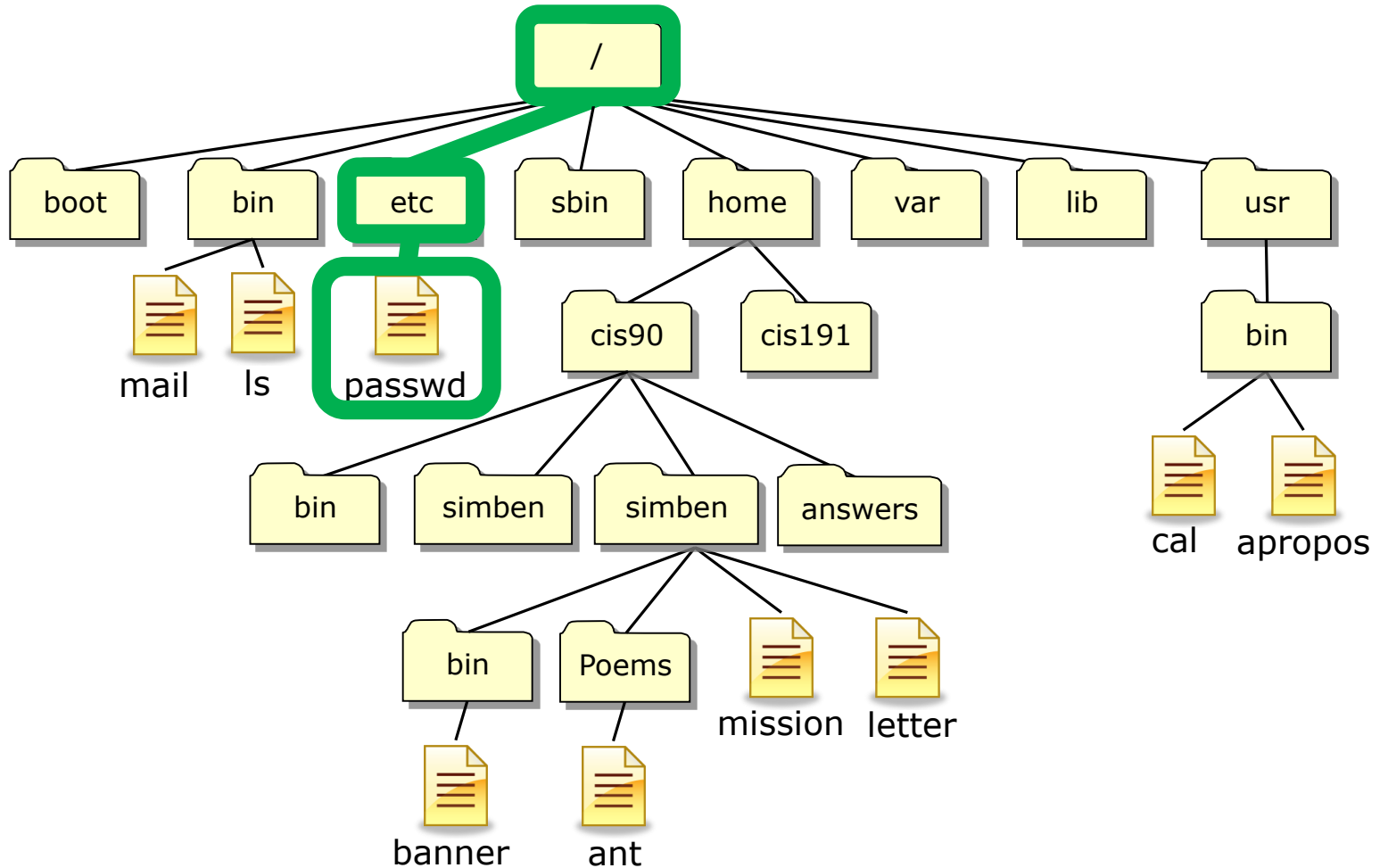
/ by itself is the root or "slash" directory, the top of the tree, not to be confused with the root user's home directory (/root)

/ at the beginning of a pathname indicates an absolute path

/ at the end of a filename indicates it is a directory

.. is always your current **parent** directory

. is always your current directory ("here")

~ is always your home directory

Note:
. and .. are hidden files since they start with a "."
Hidden files don't show up in ls listings unless the -a option is used

Example Sequence using / . .. and ~

1. Change to your Poems/Blake directory using a relative pathname

```
/home/cis90/simben $ cd Poems/Blake/
/home/cis90/simben/Poems/Blake $
```

2. List the directories in the / directory using an absolute pathname

```
/home/cis90/simben/Poems/Blake $ ls /
bin   dev   home   lost+found   misc   net   proc   sbin     srv   tftpboot   u     var
boot  etc   lib    media               mnt   opt   root  selinux  sys   tmp              usr
```

3. List the directories in your current parent directory using ..

```
/home/cis90/simben/Poems/Blake $ ls ..
ant   Blake   nursery   Shakespeare   twister   Yeats
```

4. List the directories in your current directory using .

```
/home/cis90/simben/Poems/Blake $ ls .
jerusalem   tiger
```

5. List the files in your home directory using ~

```
/home/cis90/simben/Poems/Blake $ ls ~
1976           empty           Lab2.0   Miscellaneous   proposal3    text.fxd
android        Hidden          Lab2.1   mission         scott        timecal
bigfile        lab01.graded    letter   Poems           small_town   uhistory
bin            lab01-submitted log      proposal1        spellk       what_am_i
dead.letter    lab02.graded    mbox     proposal2        text.err
```

146

Shell tips

(review)

bash shell tip
tab completes

- It can be tedious typing in long pathnames.

- Since bash knows the names of the files you only have to type just enough characters to uniquely specify a name and then the tab key can be pressed to complete them.

- Example: the black characters were typed by the user, the green ones were typed by bash:

```
ls /home/cis90/simben/Poems/Shakespeare/
```

tab

148

bash shell tip
command history and editing

• It can be tedious re-typing a long command to fix a typo.

• Since bash knows the commands you have previously entered, just use the up and down arrows to re-type a previous command.

• When the command you want appears, use the home, right or left arrow keys to go where you want to make the correction. New text can be inserted and old text deleted or backspaced over.

• Example: The ls command was mis-typed as la:

```
/home/cis90/simmsben $ la /home/cis90/simmsben/Poems/Shakespeare/
-bash: la: command not found
```

↑ home then fix typo

```
/home/cis90/simmsben $ ls /home/cis90/simmsben/Poems/Shakespeare/
sonnet1    sonnet11   sonnet17   sonnet26   sonnet35   sonnet5   sonnet9
sonnet10   sonnet15   sonnet2    sonnet3    sonnet4    sonnet7
/home/cis90/simmsben $
```

149

Using pathnames as arguments

Task: cat the tiger file from your home directory

How can we do this?

151
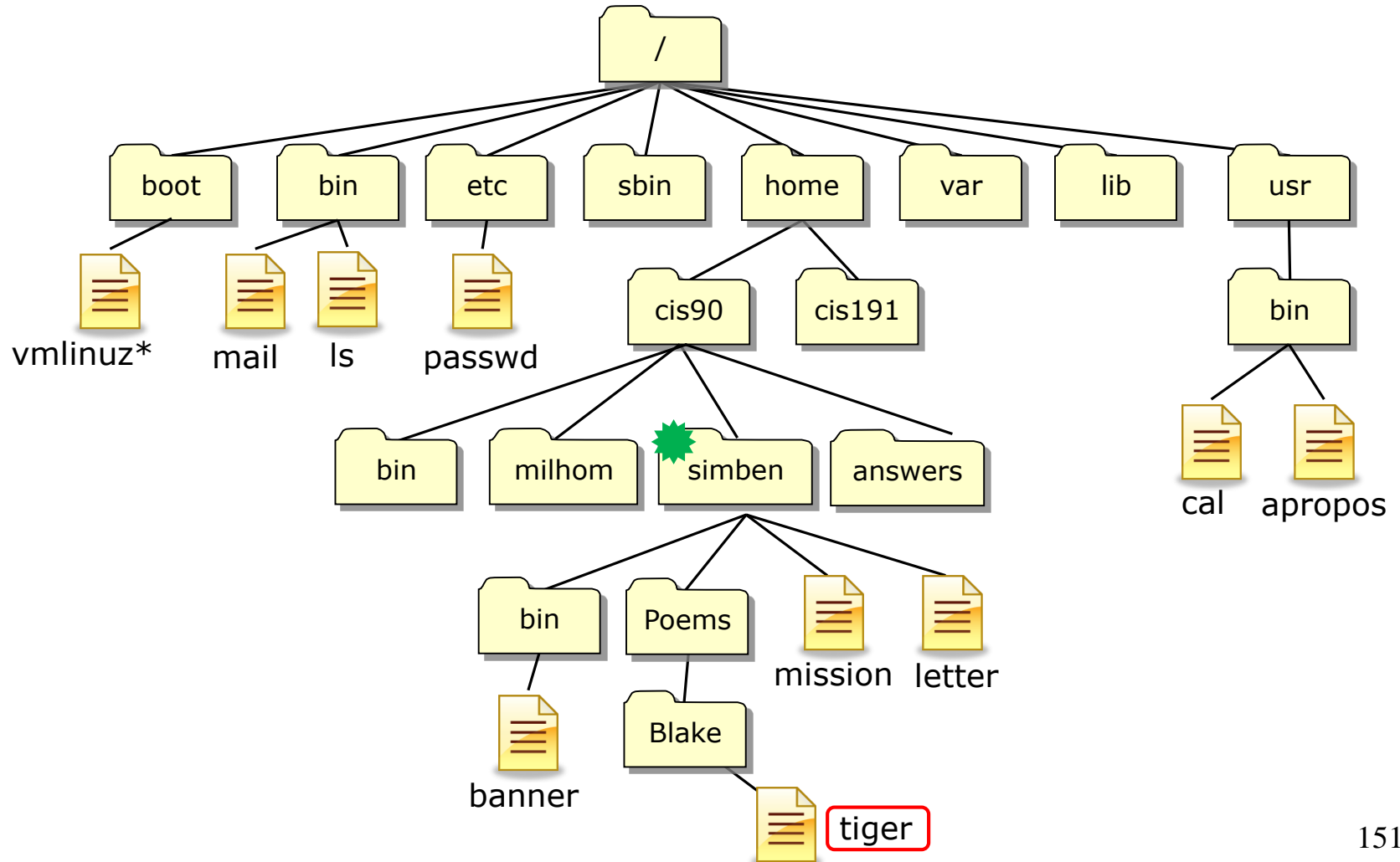
Task: cat the tiger file from your home directory

Option 1: "Navigate" to the directory then cat the file

```
/home/cis90/simben $ cd        start in our home directory

/home/cis90/simben $ ls          see what's there
bigfile      Hidden          log              proposal1    text.err
bin          lab01.graded    mbox             proposal2    text.fxd
countargs    Lab2.0          Miscellaneous    proposal3    timecal
dead.letter  Lab2.1          mission          small_town   uhistory
empty        letter          Poems            spellk       what_am_i

/home/cis90/simben $ cd Poems/     descend into the Poems directory
/home/cis90/simben/Poems $ ls    see what's there
ant  Blake  nursery  Shakespeare  twister  Yeats

/home/cis90/simben/Poems $ cd Blake/     descend into the Blake directory
/home/cis90/simben/Poems/Blake $ ls      see what's there
jerusalem  tiger

/home/cis90/simben/Poems/Blake $ cat tiger
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
```

152

Task: cat the tiger file from your home directory

Option 2: Use a relative pathname

```
/home/cis90/simben $ cat Poems/Blake/tiger
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
/home/cis90/simben $
```

Task: cat the tiger file from your home directory
Option 3: Use an absolute pathname

```
/home/cis90/simben $ cat /home/cis90/simben/Poems/Blake/tiger
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
/home/cis90/simben $
```

Task: cat the tiger file from your home directory

Option 4: communicating with the shell using ESP

```
/home/cis90/simben $ cat tiger
cat: tiger: No such file or directory
/home/cis90/simben $
```

ESP is not an option!

There is no tiger file in the /home/cis90/simben directory.

There are over 40 tiger files on Opus.

If you don't give the shell a correct pathname that unambiguously specifies the location of a file in the file tree you should expect this error.

Don't expect the shell to read your mind as to which file in the file tree you are thinking about!

155

Task: cat the tiger file from your home directory

Navigating to the directory then catting the file

```
/home/cis90/simben $ cd Poems/; cd Blake; cat tiger; cd
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
```

Using a relative pathname

```
/home/cis90/simben $ cat Poems/Blake/tiger
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
```

This is the option I would choose (fewest keystrokes)

Using an absolute pathname

```
/home/cis90/simben $ cat /home/cis90/simben/Poems/Blake/tiger
Tiger, Tiger burning bright
In the forest of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?
```

Using ESP method

```
/home/cis90/simben $ cat tiger
cat: tiger: No such file or directory
```

156

cd command (your legs)

cd command
change directory

- Syntax: **cd [*directory*]**

- Changes the current working directory to the directory specified.

- Use **cd** with no arguments to return to your home directory.

   Note, users always start in their home directory after logging in.
   Every user's home directory is configured in the /etc/passwd file.

- The *directory* can be:
   An absolute pathname, e.g. **cd /home/cis90/simben/Poems/Yeats**
   A relative pathname, e.g. **cd Poems/Yeats**
   A **..** for the parent of the current working directory, e.g. **cd ..**

- Note, **cd** is a Bash builtin command (part of the shell itself)
   ```
   /home/cis90/simben $ type cd
   cd is a shell builtin
   ```

158

The .. directory

To move up the tree use: **cd ..**

.. is a hidden file located in every single directory and it is hard linked to the absolute pathname of the parent directory

cd command
change directory example

```
/home/cis90/simmen $ echo $HOME
/home/cis90/simben
/home/cis90/simmsben $ echo $PS1
$PWD $
```
1. `/home/cis90/simmen $ cd Poems/`
2. `/home/cis90/simben/Poems $ cd Shakespeare/`
3. `/home/cis90/simben/Poems/Shakespeare $ cd ..`
4. `/home/cis90/simben/Poems $ cd Blake/`
5. `/home/cis90/simben/Poems/Blake $ cd ..`
6. `/home/cis90/simben/Poems $ cd ..`
7. `/home/cis90/simben $ cd /home`
8. `/home $ cd ..`
9. `/ $ cd /home/cis90/simben/Poems/Blake/`
10. `/home/cis90/simben/Poems/Blake $ cd`
11. `/home/cis90/simben $ cd ../../`
12. `/home $ cd`
13. `/home/cis90/simben $`

Benji's home directory

160
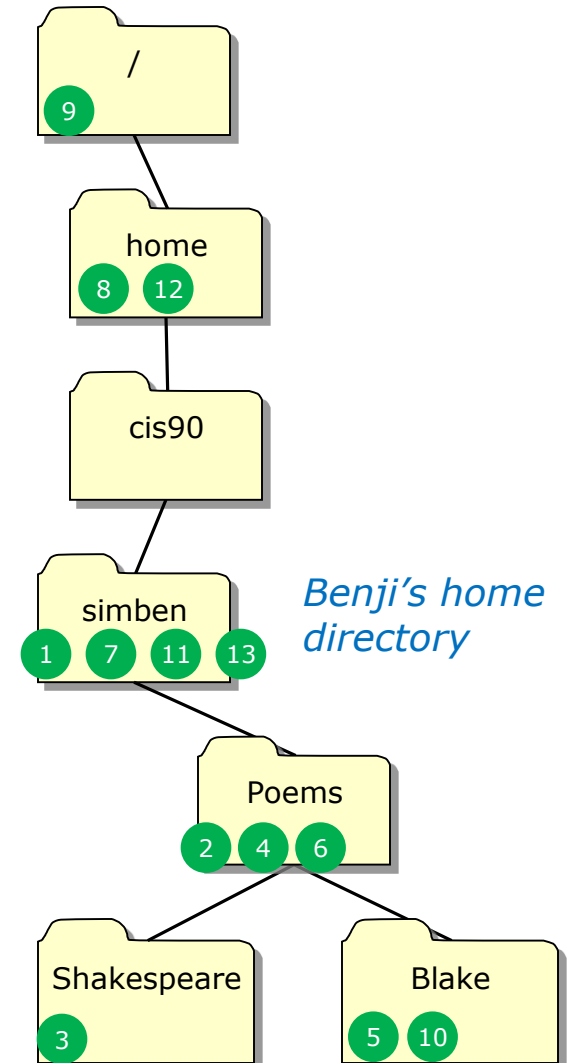
pwd command (your GPS)

pwd command
print working directory

- The **pwd** command is your "GPS" to show your current location on the UNIX file tree. Especially with more typical prompts!

- The **pwd** command is equivalent to displaying the value of the PWD environment variable

```
[rsimms@opus net]$ pwd
/lib/modules/2.6.18-164.el5/kernel/drivers/net
```
This is a UNIX command

This is a UNIX command   *This is shell environment variable (used as an argument to the echo command)*

```
[rsimms@opus net]$ echo $PWD
/lib/modules/2.6.18-164.el5/kernel/drivers/net
```

Note: The default shell prompt CIS 90 students utilizes the PWD variable to always show the current working directory.

i.e. When CIS 90 students login this command: PS1='$PWD $ ' is automatically done as part of setting up their shell environment.

/

lib

modules

2.6.18-164.e15

kernel

drivers

net

162
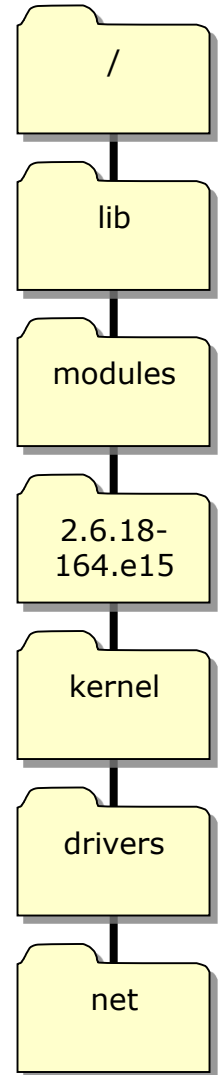
pwd command
print working directory

Note: The shell prompt has been configured for CIS 90 students to always show the current working directory. This example shows the pwd command with a more typical prompt.

- Syntax: **pwd**

- Prints the current working directory.

- pwd is a BASH builtin command (part of the shell itself)
    /home/cis90/simben $ **type pwd**
    pwd is a shell builtin

```
/home/cis90/simben $ PS1='[\u@\h \W]\$ '
[simben90@opus ~]$ pwd
/home/cis90/simben
[simben90@opus ~]$ cd Poems/Shakespeare/
[simben90@opus Shakespeare]$ pwd
/home/cis90/simben/Poems/Shakespeare
[simben90@opus Shakespeare]$ cd /home/
[simben90@opus home]$ pwd
/home
/home/cis90/simben $ PS1='$PWD $ '
/home/cis90/simben $
```

163
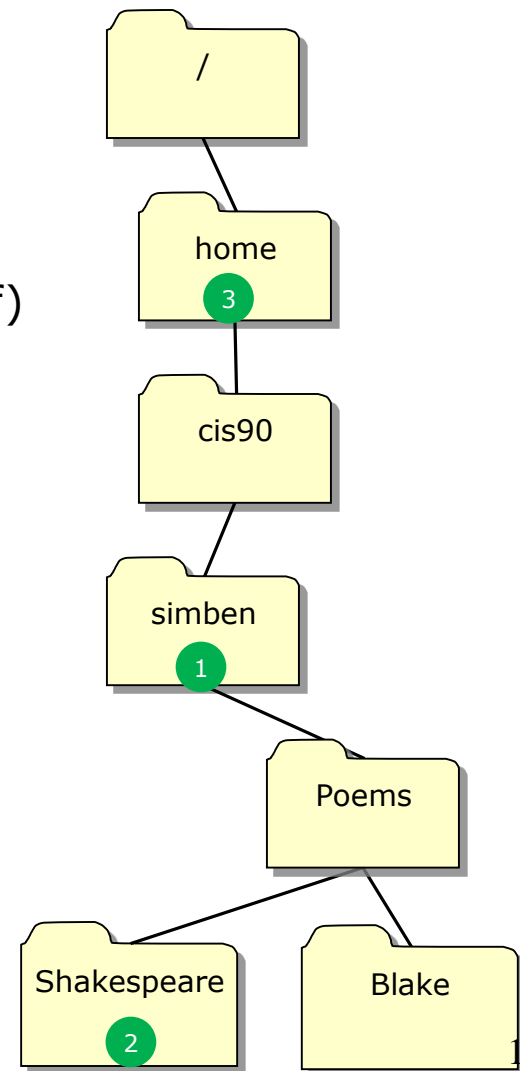
ls command (your eyes)

ls command
Using files vs directories as arguments

With no arguments specified, all files in the current directory will be listed

```
/home/cis90/simben $ ls
bigfile   Lab2.0        mission    proposal3   text.fxd
bin       Lab2.1        Poems      small_town  timecal
empty     letter        proposal1  spellk      what_am_i
Hidden    Miscellaneous proposal2  text.err
```

```
/home/cis90/simben $ ls bigfile
bigfile
```

*With a **filename** specified as an argument, just that file will be listed*

```
/home/cis90/simben $ ls Poems/
ant  Blake  nursery  Shakespeare  twister  Yeats
```

*With a **directory** specified as an argument, the contents of the directory will be listed*

165

ls command
specifying multiple directories

*The **ls** command can take multiple arguments*

regular file

When a file is specified, just the filename is listed

```
/home/cis90/simben $ ls Poems/ bin/ letter
letter
```

directories

```
bin/:
app  banner  enlightenment  hi  I  treed  tryme  zoom

Poems/:
ant  Blake  nursery  Shakespeare  twister  Yeats
```

When a directory is specified, the contents of the directory are listed

166

ls command

- Syntax: **ls [options] [*directory*]...**

Option	Description
-a	Show all files, even the hidden ones with names starting with "."
-i	Show inode numbers
-d	Show the directory itself rather than the contents of the directory
-l	Long listing (lots of inode information)
-F	Show file types (directory/, program*, link@, socket=)
-S	Sort by size
-t	Sort by date
-R	Recursive (show all sub-directories)

- The *directory* argument can be:
  An absolute pathname, e.g. **cd /home/cis90/milhom/Poems/**
  A relative pathname, e.g. **cd Poems**
  If no directory is specified, the current working directory is used.
  More than one directory can be specified

- Use **man ls** to see more information.

ls command
List Files

FYI ...

- **ls** is in /bin and has been aliased to use color on terminal output

```
[simmsben@opus ~]$ type -a ls
ls is aliased to `ls --color=tty'
ls is /bin/ls
```

Using the type command to show where a command resides on the path

Note: the `--color=tty` is an option on the **ls** command. Options that are fully spelled usually use two dashes -- instead of 1

We will learn about aliases later in the course

ls command example
with no options

Regular files in black

```
/home/cis90/simmsben $ ls
bigfile   Hidden   letter          Poems       proposal3   text.err   what_am_i
bin       Lab2.0   Miscellaneous   proposal1   small_town  text.fxd
empty     Lab2.1   mission         proposal2   spellk      timecal
```

Directories in blue

Executables (programs or scripts) in green

*Using the **ls** command with no arguments will list the files in the current directory*

169

ls command example
with the -F option

Regular files have no suffix

```
/home/cis90/simmsben $ ls -F
bigfile   Hidden/   letter          Poems/      proposal3    text.err   what_am_i
bin/      Lab2.0/   Miscellaneous/  proposal1   small_town   text.fxd
empty     Lab2.1/   mission         proposal2   spellk       timecal*
```

Directories end with /

*Executables (programs or scripts) end with ***

*Use the **-F** option to show file types with symbols rather than color (helpful if you are color blind)*

170

ls command example
with the -a option

Lab 4

/home/cis90/simmsben $ **cd**   *cd with no arguments takes you to your home directory*

/home/cis90/simmsben $ **ls -a**

```
.                 .bashrc    Hidden         Miscellaneous  proposal1   text.err
..                bigfile    Lab2.0         mission        proposal2   text.fxd
.bash_history     bin        Lab2.1         .mozilla       proposal3   timecal
.bash_logout      .emacs     .lesshst       .plan          small_town  what_am_i
.bash_profile     empty      letter         Poems          spellk      .zshrc
/home/cis90/simmsben $
```

Use the -a option to show hidden files (files whose names start with a ".")

.. a hidden file, is the parent directory

. a hidden file, is this the current directory, think of . as meaning "here"

171

ls command example
with the -S option

```
/home/cis90/simben $ ls -lS
total 132
-rw-rw-r--. 1 simben90 cis90  21762 Sep 18 15:30 uhistory
-rw-r--r--. 2 simben90 cis90  10576 Jul 20  2001 bigfile
drwxr-xr-x. 2 simben90 cis90   4096 Sep 11  2005 bin
d---------. 2 simben90 cis90   4096 Feb  1  2002 Hidden
drwxr-xr-x. 2 simben90 cis90   4096 Feb 17  2001 Lab2.0
drwxr-xr-x. 3 simben90 cis90   4096 Feb 17  2001 Lab2.1
drwxr-xr-x. 2 simben90 cis90   4096 Sep 11  2005 Miscellaneous
drwxr-xr-x. 5 simben90 cis90   4096 Sep 18 08:49 Poems
-rw-rw-r--. 1 simben90 cis90   4008 Sep 11 22:23 archives
-rw-rw-r--. 1 simben90 cis90   3766 Sep 12 18:53 mbox
-r--------. 1 simben90 staff   2780 Sep  6 13:47 lab01.graded
-rw-r--r--. 1 simben90 cis90   2175 Jul 20  2001 proposal2
-rw-r--r--. 1 simben90 cis90   2054 Sep 14  2003 proposal3
-rw-------. 1 simben90 cis90   1892 Sep 18 15:29 dead.letter
-rw-r--r--. 1 simben90 cis90   1580 Nov 16  2004 small_town
-r--------. 1 simben90 staff   1312 Sep 13 12:27 lab02.graded
-rw-rw-r--. 1 simben90 cis90   1194 Sep 12 15:19 mymessages
-rw-r--r--. 1 simben90 cis90   1074 Aug 26  2003 proposal1
-rw-r--r--. 1 simben90 cis90   1044 Jul 20  2001 letter
-rw-r--r--. 1 simben90 cis90    759 Jun  6  2002 mission
-rwxr-xr-x. 1 simben90 cis90    509 Jun  6  2002 timecal
-rw-r--r--. 1 simben90 cis90    485 Aug 26  2003 spellk
-rw-r--r--. 1 simben90 cis90    352 Jul 20  2001 what_am_i
-rw-r--r--. 1 simben90 cis90    250 Jul 20  2001 text.err
-rw-r--r--. 1 simben90 cis90    231 Jul 20  2001 text.fxd
-rw-r--r--. 1 simben90 cis90     52 Sep  3 10:03 log
-rw-r--r--. 1 simben90 cis90      0 Jul 20  2001 empty
/home/cis90/simben $
```

Note directories all have the same size (4096 bytes)

Use the -S option to sort files by size

172

ls command example
with the -i option

Lab 4

/home/cis90/simmsben $ **cd**   *cd with no arguments take you to your home directory*

/home/cis90/simmsben $ **ls -i**

9171	archives	9351	lab02.graded	12107	mission	12137	spellk
12613	bigfile	12080	Lab2.0	9233	mymessages	12138	text.err
12067	bin	12091	Lab2.1	12109	Poems	12139	text.fxd
9087	dead.letter	9662	letter	12133	proposal1	12140	timecal
12076	empty	14208	log	12134	proposal2	9249	uhistory
12077	Hidden	9142	mbox	12135	proposal3	12141	what_am_i
15725	lab01.graded	12102	Miscellaneous	12136	small_town		

*Use the **-i** option to show the inode associated with a filename*

This command shows exactly what is kept in a directory: filename & inode pairs (kind of like a phone book)

ls command
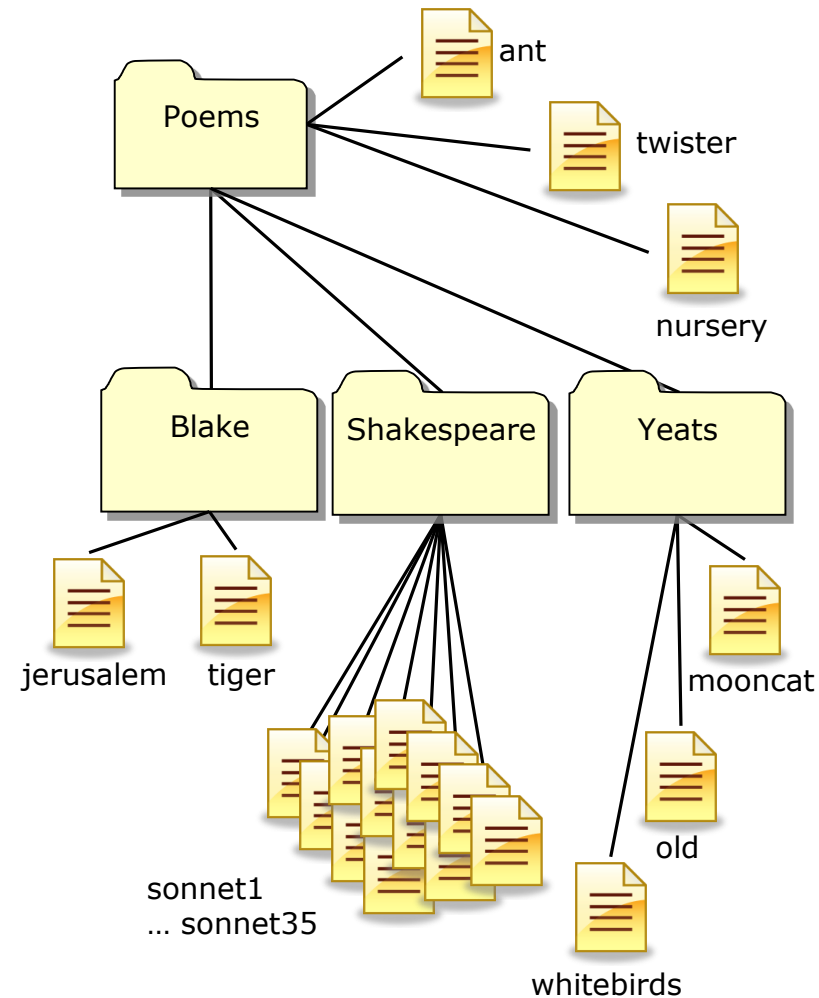## *with the -IR options*

long listing and recursive

```
simmsben@opus:~/Poems
[simmsben@opus Poems]$ls -lR
.:
total 48
-rw-r--r-- 1 simmsben cis90  237 Aug 26  2003 ant
drwxr-xr-x 2 simmsben cis90 4096 Jul 20  2001 Blake
-rw-r--r-- 1 simmsben cis90  779 Oct 12  2003 nursery
drwxr-xr-x 2 simmsben cis90 4096 Oct 31  2004 Shakespeare
-rw-r--r-- 1 simmsben cis90  151 Jul 20  2001 twister
drwxr-xr-x 2 simmsben cis90 4096 Jul 20  2001 Yeats

./Blake:
total 16
-rw-r--r-- 1 simmsben cis90 582 Jul 20  2001 jerusalem
-rw-r--r-- 1 simmsben cis90 115 Jul 20  2001 tiger

./Shakespeare:
total 104
-rw-r--r-- 1 simmsben cis90 614 Jul 20  2001 sonnet1
-rw-r--r-- 1 simmsben cis90 620 Jul 20  2001 sonnet10
-rw-r--r-- 1 simmsben cis90 689 Oct 31  2004 sonnet11
-rw-r--r-- 1 simmsben cis90 618 Jul 20  2001 sonnet15
-rw-r--r-- 1 simmsben cis90 647 Jul 20  2001 sonnet17
-rw-r--r-- 1 simmsben cis90 631 Jul 20  2001 sonnet2
-rw-r--r-- 1 simmsben cis90 601 Jul 20  2001 sonnet26
-rw-r--r-- 1 simmsben cis90 615 Jul 20  2001 sonnet3
-rw-r--r-- 1 simmsben cis90 598 Jul 20  2001 sonnet35
-rw-r--r-- 1 simmsben cis90 588 Jul 20  2001 sonnet4
-rw-r--r-- 1 simmsben cis90 622 Jul 20  2001 sonnet5
-rw-r--r-- 1 simmsben cis90 581 Jul 20  2001 sonnet7
-rw-r--r-- 1 simmsben cis90 620 Jul 20  2001 sonnet9

./Yeats:
total 24
-rw-r--r-- 1 simmsben cis90 855 Jul 20  2001 mooncat
-rw-r--r-- 1 simmsben cis90 520 Jul 20  2001 old
-rw-r--r-- 1 simmsben cis90 863 Jul 20  2001 whitebirds
[simmsben@opus Poems]$
```


Poems — ant, twister, nursery

Blake — jerusalem, tiger

Shakespeare — sonnet1 … sonnet35

Yeats — mooncat, old, whitebirds

174

ls command
with the -d option

/home/cis90/simben $ **ls bin**
app banner enlightenment hi I treed tryme zoom

The contents of the directory are shown

/home/cis90/simben $ **ls -d bin**
bin

The directory itself is shown with the -d option

*Use the **d** option to list the directory itself. Without the **d** the directory contents are listed instead.*

ls command
with the -d option

```
simben90@opus:~

/home/cis90/simben $ ls -l bin
total 68
-rwxr-xr-x 1 simben90 cis90  220 Apr 22  2004 app
-rwxr-xr-x 1 simben90 cis90 6160 Aug 28  2003 banner
-rwxr-xr-x 1 simben90 cis90 3442 Feb  4 16:36 enlightenment
-rwxr-xr-x 1 simben90 cis90  107 Jul 20  2001 hi
-rwxr-x--x 1 simben90 cis90  375 Oct 20  2003 I
-rwxr-xr-x 1 simben90 cis90  190 Jul 20  2001 treed
-rwxr-xr-x 1 simben90 cis90  174 Mar  4  2004 tryme
-rwxr-xr-x 1 simben90 cis90   74 Jul 20  2001 zoom
/home/cis90/simben $
/home/cis90/simben $ ls -ld bin
drwxr-xr-x 2 simben90 cis90 4096 Feb 12 16:07 bin
/home/cis90/simben $
```
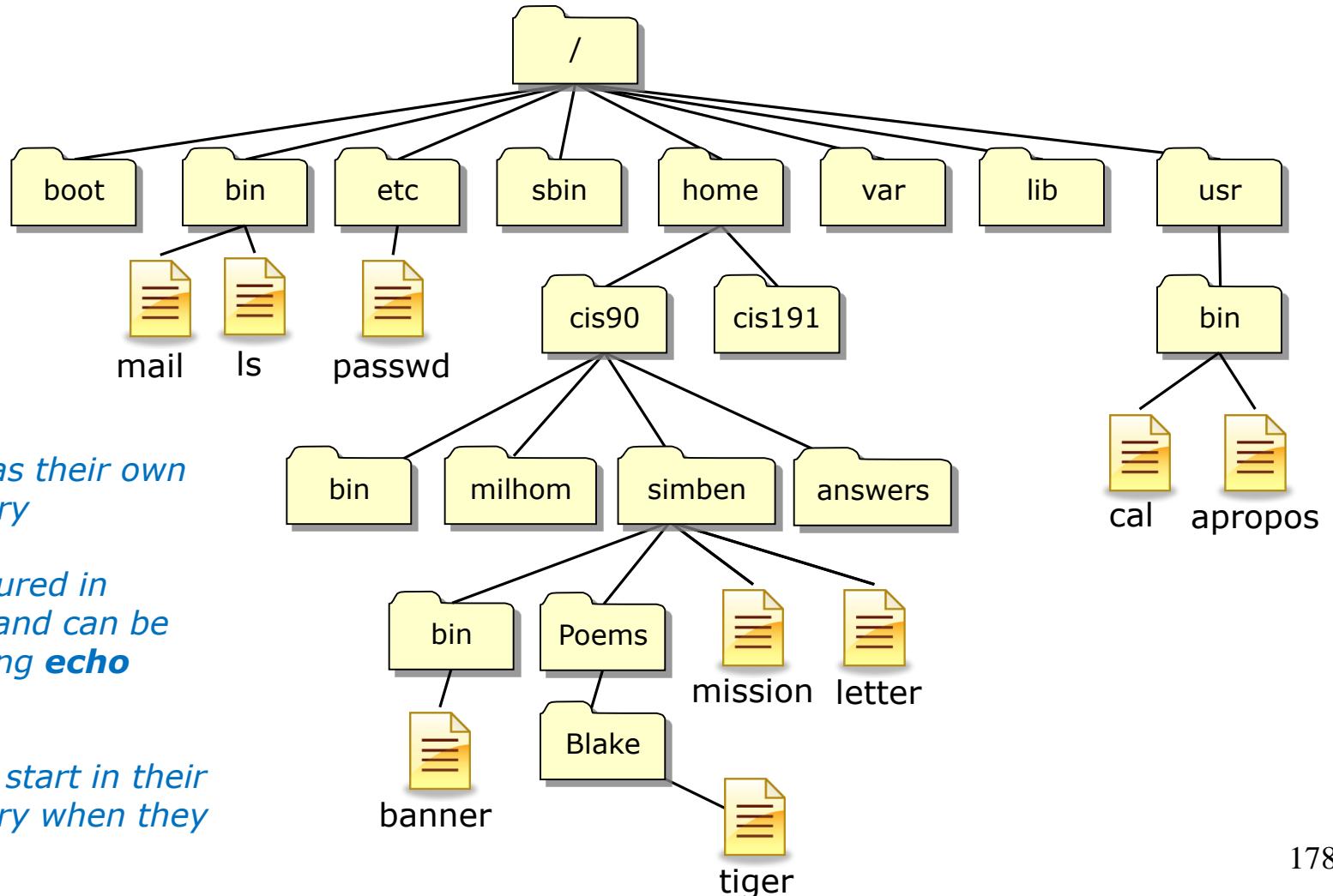
The directory contents are shown

The directory itself is shown with the -d option

Home directories

UNIX File Tree
/ = root of the tree

Every user has their own home directory

This is configured in /etc/passwd and can be displayed using **echo $HOME**

Users always start in their home directory when they login

178

Class Activity

1) Find your entry (use your own logname) in /etc/passwd

```
/home/cis90/simben $ grep simben90 /etc/passwd

simben90:x:1047:190:Benji Simms:/home/cis90/simben:/bin/bash
```

2) Show the contents of the HOME variable

```
/home/cis90/simben $ echo $HOME

/home/cis90/simben
```

3) List the contents of your home directory

```
/home/cis90/simben $ ls /home/cis90/simben

archives        empty         Lab2.0    Miscellaneous    proposal2    text.err     uhistory.bak
bigfile         Hidden        Lab2.1    mission          proposal3    text.fxd     what_am_i
bin             lab01.graded  letter    Poems                         small_town   timecal
dead.letter     lab02.graded  log       proposal1        spellk       uhistory
```

179

Question:

What are some different ways to get the inode number of your home directory?

Question: What are some different ways to get the inode number of your home directory while you are in your home directory?

Answer: At least four ways:

① `/home/cis90/simben $ ls -id /home/cis90/simben/`
   `9017 /home/cis90/simben/`

Specify the absolute pathname of the home directory

② `/home/cis90/simben $ ls -id .`
   `9017 .`

Using the . if you are currently in your home directory

③ `/home/cis90/simben $ ls -id ~`
   `9017 /home/cis90/simben`

The ~ is always an absolute pathname to home directory

④ `/home/cis90/simben $ ls -i /home/cis90`

Using contents of the parent directory

```
13658 answers   12656 depot     9342 keljos    9605 mosmic    9559 specod
 9062 beakie     9154 fahmic     9348 lefnic    9460 patcar    9635 thinic
12625 bin        9277 fitcon     9354 lehreb    9484 perste    9573 tilbuz
 9074 calmic     9647 genmar     9374 lemrob    9653 ramenr    9579 vasjor
 9087 casenr    11282 guest      9389 malmil    9535 ramjua    9629 vivrut
 9100 casric     9283 gutemi     9641 matjon    9032 rodduk    9611 weljon
 6782 cis        9297 hictre     9131 mccpat    9544 rudtro    9585 weltim
 9137 daweli     9312 hormat     9023 milhom    9017 simben
```

Note the use of the -d option on ls to focus on the directory itself rather than the directory contents

181

Filename expansion with *
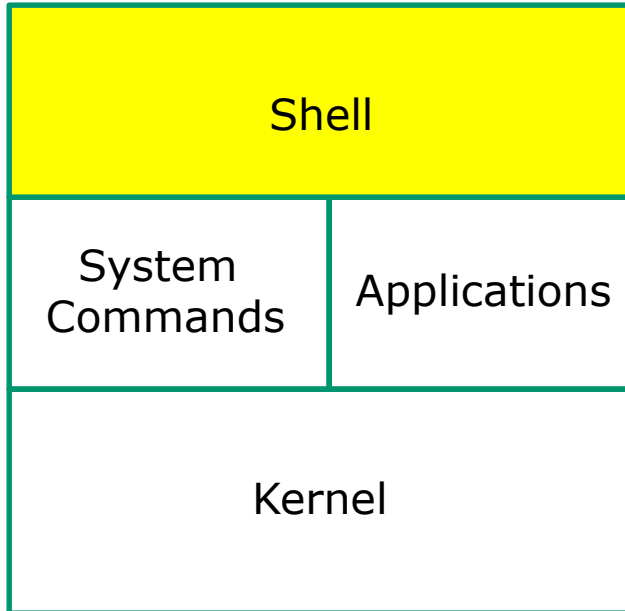
The "*" metacharacter

The * is expanded by the shell and replaced with the names of all files and directories in the current directory

```
/home/cis90/simben $ file *
archives:       ASCII mail text
bigfile:        ISO-8859 English text, with overstriking
bin:            directory
dead.letter:    ASCII text
empty:          empty
Hidden:         directory
lab01.graded:   ASCII English text
lab02.graded:   ASCII English text
Lab2.0:         directory
Lab2.1:         directory
letter:         ASCII English text
log:            ASCII text
Miscellaneous:  directory
mission:        ASCII English text
Poems:          directory
proposal1:      ASCII English text
proposal2:      ASCII English text
proposal3:      ASCII English text
small_town:     ASCII English text
spellk:         ASCII English text
text.err:       ASCII text
text.fxd:       ASCII text
timecal:        Bourne-Again shell script text executable
uhistory:       ASCII mail text
uhistory.bak:   ASCII mail text
what_am_i:      data
```

183

Life of the Shell

1) Prompt

2) **Parse**

3) Search

4) Execute

5) Nap

6) Repeat

Metacharacters, like the *, are processed and expanded during the Parse step

(before the selected command is even run)

Shell

System Commands

Applications

Kernel

184

*

filename expansion metacharacter

- The * is a shell metacharacter

- During the **parse step** the shell expands * and replaces it with matching filenames in the current directory or as part of any pathnames specified as arguments.

- The commands loaded by the shell never see the *, instead then see the expanded filenames.

- The * will only match non-hidden filenames when used by itself.

*

filename expansion metacharacter

```
/home/cis90/simben/Poems/Yeats $ ls
mooncat   old   whitebirds


/home/cis90/simben/Poems/Yeats $ file mooncat old whitebirds
mooncat:     ASCII English text
old:         ASCII English text
whitebirds:  ASCII English text
```

*user manually
types in each
filename in
directory*

```
/home/cis90/simben/Poems/Yeats $ file *
mooncat:     ASCII English text
old:         ASCII English text
whitebirds:  ASCII English text
```

*User let's the shell
do the work instead*

*In the second example, the shell, during the parse step, expands the *
and replaces it with mooncat old whitebirds.*

*The **file** command never sees the "*"*

186

Example program to process: file command

`/home/cis90/simben/Poems/Yeats $ ` **`file *`**

*The shell expands the * to mooncat old whitebirds
which is passed to the file command to process.*

*The file command
never sees the **

stdout

Options: NA
Args: mooncat old whitebirds

```
mooncat:     ASCII English text
old:         ASCII English text
whitebirds:  ASCII English text
```

0 **file** 1

2

stdin

requests to the kernel
result in obtaining file
information on
mooncat, old and
whitebirds files

stderr

187
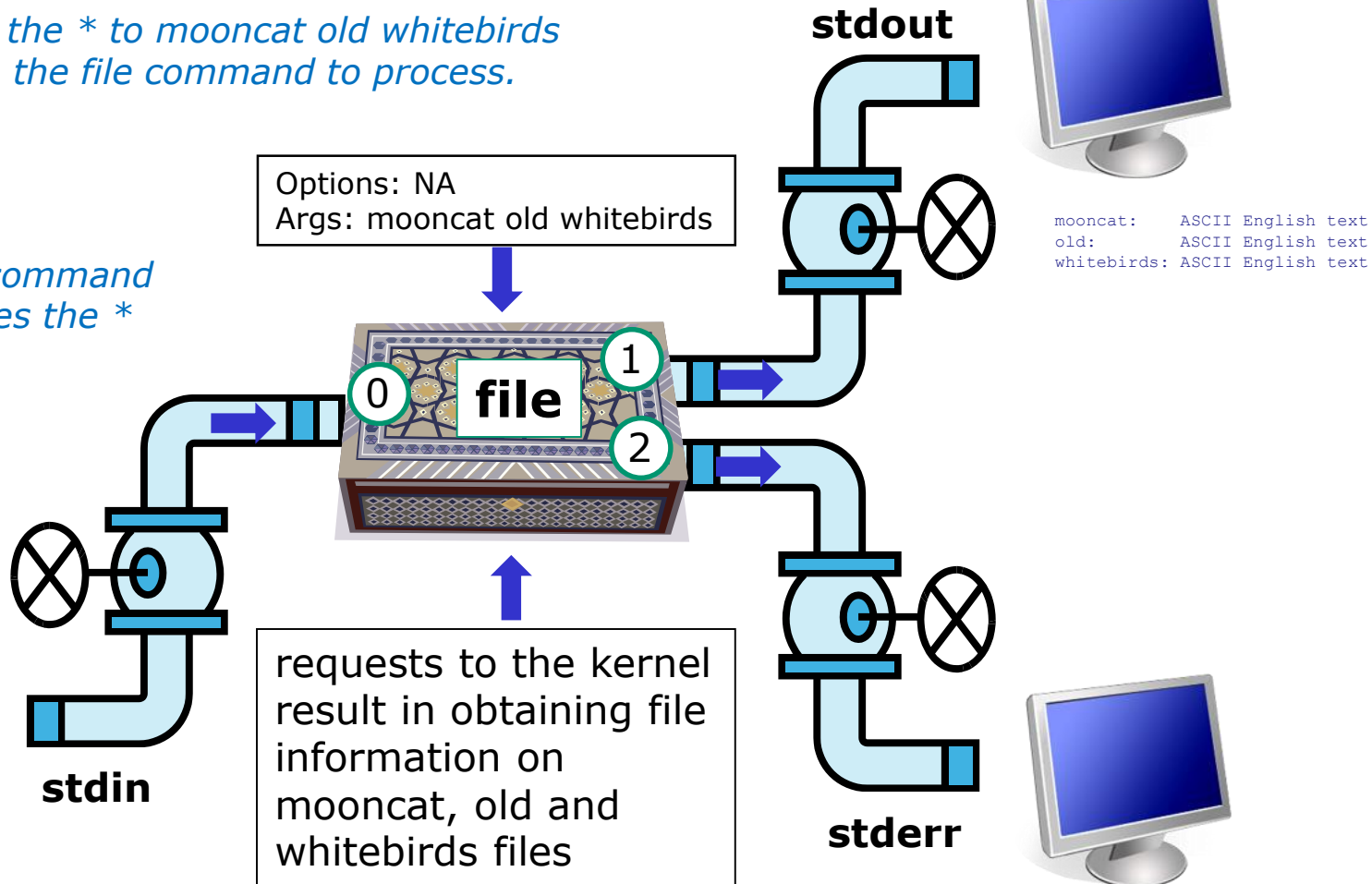
* metacharacter
used as a *prefix* character

```
/home/cis90/simben $ ls
bigfile    Lab2.0          mission      proposal3   text.fxd
bin        Lab2.1          Poems        small_town  timecal
empty      letter          proposal1    spellk      what_am_i
Hidden     Miscellaneous   proposal2    text.err

/home/cis90/simben $ ls *.err
text.err
```

*.err matches all file names **ending** with ".err"

Shell operation question: Does the **ls** command see the "***" typed by the user?

188

* metacharacter
used as an *infix* character

```
/home/cis90/simben $ ls
bigfile    Lab2.0           mission      proposal3    text.fxd
bin        Lab2.1           Poems        small_town   timecal
empty      letter           proposal1    spellk       what_am_i
Hidden     Miscellaneous    proposal2    text.err

/home/cis90/simben $ ls *am*
what_am_i
```

am matches all file names **containing** "am"

Answer to the question on previous slide: NO! The shell replaced the ".err" with the string "text.err" and that's what the **ls** command received as an argument.*

* metacharacter
used as a *postfix* character

```
/home/cis90/simben $ ls
bigfile   Lab2.0         mission     proposal3   text.fxd
bin       Lab2.1         Poems       small_town  timecal
empty     letter         proposal1   spellk      what_am_i
Hidden    Miscellaneous  proposal2   text.err

/home/cis90/simmen $ ls p*
proposal1   proposal2   proposal3
```

p matches all file names **starting** with a "p"*

190

Class Activity

List all poems in the CIS 90 student home directories whose filename contains "cat"

Type the name of these files in the chat window

`ls ../*/Poems/*/*cat*`

The path to enlightenment

UNIX Files
The three elements of a file

```
/home/cis90/simben/Poems $ ls
ant   Blake   nursery   Shakespeare   twister   Yeats


/home/cis90/simben/Poems $ ls -li twister
102625 -rw-r--r-- 1 simben90 cis90 151 Jul 20  2001 twister


/home/cis90/simben/Poems $ cat twister
A tutor who tooted the flute,
tried to tutor two tooters to toot.
Said the two to the tutor,
"is it harder to toot?  Or to
tutor two tooters to toot?"
```

filename
+
inode
+
data

193

Class Exercise
Enlightenment

- **cd** to your home directory on Opus

- Run the enlightenment program: **enlightenment**

- Write down each magic word as you learn them.

Assignment

Lab 4

If you get stuck, please ask questions on the forum or ask one of the lab assistants in the CIS Lab.

Wrap up

Commands:

cat	Print a file on the screen
cd	Change directory
file	Classify a file
head	View first several lines of a file
less	Scroll up and down long files
ls	List files
more	Scroll down long files
pwd	Print working directory
reset	Use to reset terminal window
tail	View last several lines of a file
wc	Count the words, lines or characters in a file
xxd	Hex dump of a binary file

New Files and Directories:

/	"slash" directory, the root of the file tree
/home	User home directories
/home/cis90	CIS 90 class home directories
/home/cis90/*username*	The home directory for CIS 90 student *username (without the 90)*
/etc/passwd	The absolute pathname of the passwd file in the /etc/ directory

Next Class

Assignment: Check Calendar Page on web site to see what is due next week.

Lab 4

Quiz questions for next class:

1) What are two commands you can use to read through long text files?

2) How do you distinguish between relative and absolute pathnames?

3) What are the three elements of a UNIX file?

End Meeting

End Meeting

Backup

Parsing & Command Syntax

Shell prints this to prompt user to enter a command

Shell parses this command line

Prompt	Command	Options	Arguments	Redirection

Options modify the behavior of the command

Examples

Arguments are what the command works upon

```
/home/cis90/simben $
/home/cis90/simben $ ls
/home/cis90/simben $ ls -l
/home/cis90/simben $ ls -l -t
/home/cis90/simben $ ls -li Poems/
/home/cis90/simben $ ls -a Poems/ bin/
/home/cis90/simben $ ls -d Poems/ bin/ > mylist
```

Redirection is covered later in the course

Spaces (blanks) are used to separate the command, options and arguments. Additional blanks are ignored.

203