

## CSE 390a Lecture 2

Exploring Shell Commands, Streams, and Redirection

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## Lecture summary

- Unix file system structure
- Commands for file manipulation, examination, searching
- Java compilation: using parameters, input, and streams
- Redirection and Pipes

## Unix file system

directory	description
/	root directory that contains all others (drives do not have letters in Unix)
/bin	programs
/dev	hardware devices
/etc	system configuration files <ul style="list-style-type: none"> <li>▪ /etc/passwd stores user info</li> <li>▪ /etc/shadow stores passwords</li> </ul>
/home	users' home directories
/media, /mnt, ...	drives and removable disks that have been "mounted" for use on this computer
/proc	currently running processes (programs)
/tmp, /var	temporary files
/usr	user-installed programs

## Links

command	description
ln	create a link to a file
unlink	remove a link to a file

- **hard link:** Two names for the same file.
  - \$ ln foo bar
  - the above command links bar as a duplicate name for foo
    - if one is modified, the other is too; follows file moves
- **soft (symbolic) link:** A reference to another existing file.
  - \$ ln -s foo bar
  - the above command creates a reference bar to the file foo
    - bar can be used as though it were foo
    - but if bar is deleted, foo will be unaffected

## File examination

command	description
cat	output a file's contents on the console
more or less	output a file's contents, one page at a time
head, tail	output the first or last few lines of a file
wc	count words, characters, and lines in a file
du	report disk space used by a file(s)
diff	compare two files and report differences

- Let's explore what we can do here...

## Searching and sorting

command	description
grep	search a file for a given string
sort	convert an input into a sorted output by lines
uniq	strip duplicate (adjacent) lines
find	search for files within a given directory
locate	search for files on the entire system
which	shows the complete path of a command

- grep is actually a very powerful search tool; more later...
- *Exercise* : Given a text file names.txt, display the students arranged by the reverse alphabetical order of their names.

## Keyboard shortcuts

^*KEY* means hold Ctrl and press *KEY*

key	description
Up arrow	repeat previous commands
Home/End or ^A/^E	move to start/end of current line
"	quotes surround multi-word arguments and arguments containing special characters
*	"wildcard" , matches any files; can be used as a prefix, suffix, or partial name
Tab	auto-completes a partially typed file/command name
^C or ^\	terminates the currently running process
^D	end of input; used when a program is reading input from your keyboard and you are finished typing
^Z	suspends (pauses) the currently running process
^S	don't use this; hides all output until ^Q is pressed

## Programming

command	description
javac <i>ClassName</i> .java	compile a Java program
java <i>ClassName</i>	run a Java program
python, perl, ruby, gcc, sml, ...	compile or run programs in various other languages

- *Exercise* : Write/compile/run a program that prints "Hello, world!"

```
$ javac Hello.java
$ java Hello
Hello, world!
$
```

## Programming

- Creating parameter input to programs
  - `String[] args` holds any provided parameters
  - *Exercise*: modify hello world to use parameters
- Parameters not the same as the input stream!
  - *Exercise*: modify hello world to also use a Scanner to grab input

Let's revisit the standard streams...

## Streams in the Shell

- Stdin, stdout, stderr
  - These default to the console
  - Some commands that expect an input stream will thus read from the console if you don't tell it otherwise.
- *Example*: `grep hi`
  - What happens? Why?

We can change the default streams to something other than the console via redirection.

## Output redirection

`command > filename`

- run `command` and write its output to `filename` instead of to console;
  - think of it like an arrow going from the command to the file...
  - if the file already exists, it will be overwritten (be careful)
  - `>>` appends rather than overwriting, if the file already exists
  - `command > /dev/null` suppresses the output of the command
- Example: `ls -l > myfiles.txt`
- Example: `java Foo >> Foo_output.txt`
- Example: `cat > somefile.txt`  
(writes console input to the file until you press ^D)

## Input redirection

`command < filename`

- run `command` and read its input from `filename` instead of console
  - whenever the program prompts the user to enter input (such as reading from a Scanner in Java), it will instead read the input from a file
  - some commands don't use this; they accept a file name as an argument
- Example: `java Guess < input.txt`
- *Exercise*: run hello world with the input stream as a file instead of the console
- *Exercise*: Also change the output stream to write the results to file
- again note that this affects *user input*, not *parameters*
- useful with commands that can process standard input or files:
  - e.g. `grep`, `more`, `head`, `tail`, `wc`, `sort`, `uniq`, `write`

## Combining commands

`command1 | command2`

- run `command1` and send its console output as input to `command2`
- very similar to the following sequence:
 

```
command1 > filename
command2 < filename
rm filename
```
- Examples: `diff students.txt names.txt | less`  
`sort names.txt | uniq`
- *Exercise* : `names.txt` contains CSE student first names, one per line. We are interested in students whose names contain a capital "A", such as "Alisa".
  - Find out of how names containing "A" are in the file.
  - Then figure out how many characters long the name of the last student whose name contains "A" is when looking at the names alphabetically.

## Misusing pipes and cat

- Why doesn't this work to compile all Java programs?

```
ls *.java | javac
```

- Misuse of cat

- bad: `cat filename | command`
- good: `command < filename`
- bad: `cat filename | more`
- good: `more filename`
- bad: `command | cat`
- good: `command`

## Commands in sequence

`command1 ; command2`

- run `command1` and then `command2` afterward (they are not linked)

`command1 && command2`

- run `command1`, and if it succeeds, runs `command2` afterward
- will not run `command2` if any error occurs during the running of 1
- Example: Make directory `songs` and move my files into it.
 

```
mkdir songs && mv *.mp3 songs
```