CSE 390a
Lecture 6

bash scripting continued; remote X windows; unix tidbits

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Lecture summary

- more shell scripting
  - if/else
  - while/until
  - select/case
  - advanced: arrays and functions
- Remote editing/GUI
- various new Unix/Linux commands
  - file archiving and compression
  - shell history
  - newlines in Unix vs Windows

if/else

```
if [ test ]; then              # basic if
    commands
fi

if [ test ]; then              # if / else if / else
    commands1
elif [ test ]; then
    commands2
else
    commands3
fi
```

- The `[ ]` syntax is actually shorthand for a shell command called "***test***" (Try: "man test")
- there ***MUST*** be spaces as shown:

  `if` space `[` space ***test*** space `]`
- include the semi-colon after `]` (or put "`then`" on the next line)

test operators

comparison operator	description
=, !=, \<, \>	compares two **string** variables
-z, -n	tests if a string is empty (zero-length) or not empty (nonzero-length)
-lt, -le, -eq, -gt, -ge, -ne	compares **numbers**; equivalent to Java's <, <=, ==, >, >=, !=
-e, -f, -d	tests whether a given file or directory exists
-r, -w, -x	tests whether a file exists and is read/writable

```
if [ $USER = “husky14" ]; then
    echo ‘Woof! Go Huskies!’
fi

LOGINS=`w -h | wc -l`
if [ $LOGINS -gt 10 ]; then
    echo ‘attu is very busy right now!’
fi
```

*Note: **man test** will show other operators.

More `if` testing

compound comparison operators	description
`if [ expr1 -a expr2 ]; then ...` `if [ test1 ] && [ test2 ]; then ...`	and
`if [ expr1 -o expr2 ]; then ...` `if [ test1 ] || [ test2 ]; then ...`	or
`if [ ! expr ]; then ...`	not

```
# alert user if running >= 10 processes when
# attu is busy (>= 5 users logged in)
LOGINS=`w -h | wc -l`
PROCESSES=`ps -u $USER | wc -l`
if [ $LOGINS -ge 5 -a $PROCESSES -gt 10 ]; then
    echo "Quit hogging the server!"
fi
```

safecopy Exercise

- Write a script called `safecopy` that will mimic the behavior of `cp -i`:

```
$ cp –i from.txt to.txt
Do you want to overwrite to.txt? (yes/no)
```

```
$ ./safecopy from.txt to.txt
Do you want to overwrite to.txt? (yes/no)
```

safecopy Exercise Solution

```
#!/bin/bash

FROM=$1
TO=$2

if [ -e $TO ]; then
    read -p "Do you want to overwrite $TO?" ANSWER
    if  [ $ANSWER = "yes" ]; then
        cp $FROM $TO
    fi
else
    cp $FROM $TO
fi
```

BMI Exercise

- Write a program that computes the user's body mass index (BMI) to the nearest integer, as well as the user's weight class:

$$BMI = \frac{weight}{height^2} \times 703$$

BMI	Weight class
≤ 18	underweight
18 - 24	normal
25 - 29	overweight
≥ 30	obese

```
$ ./bmi
Usage: ./bmi weight height

$ ./bmi 112 72
Your Body Mass Index (BMI) is 15
Here is a sandwich; please eat.

$ ./bmi 208 67
Your Body Mass Index (BMI) is 32
There is more of you to love.
```

BMI Exercise solution

```
#!/bin/bash
# Body Mass Index (BMI) calculator
if [ $# -lt 2 ]; then
    echo "Usage: $0 weight height"
    exit 1         # 1 indicates failure, 0 for success
fi

let H2=“$2 * $2”
let BMI="703 * $1 / $H2"
echo "Your Body Mass Index (BMI) is $BMI"
if [ $BMI -le 18 ]; then
    echo "Here is a sandwich; please eat."
elif [ $BMI -le 24 ]; then
    echo "You're in normal weight range."
elif [ $BMI -le 29 ]; then
    echo "You could stand to lose a few."
else
    echo "There is more of you to love."
fi
```

Common errors

- `[: -eq: unary operator expected`
  - you used an undefined variable in an `if` test
- `[: too many arguments`
  - you tried to use a variable with a large, complex value (such as multi-line output from a program) as though it were a simple int or string
- `let: syntax error: operand expected (error token is " ")`
  - you used an undefined variable in a `let` mathematical expression

while and until loops

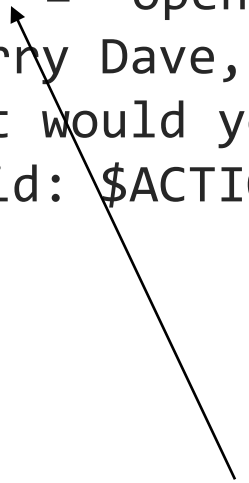
```
while [ test ]; do          # go while test is true
    commands
done


until [ test ]; do          # go while test is false
   commands
done
```

While exercise

- Prompt the user for what they would like to do. While their answer is "open the pod bay doors" tell them that you cannot do that and prompt for another action.

While Exercise solution

```
#!/bin/bash
# What would you like to do?
 read -p "What would you like me to do? " ACTION
 echo "You said: $ACTION"
 while [ "$ACTION" = "open the pod bay doors" ]; do
     echo "I'm sorry Dave, I'm afraid I can't do that."
     read -p "What would you like me to do? " ACTION
     echo "You said: $ACTION"
 done
 echo "Bye"
```



The quotes around “$ACTION” are important here, try removing them and see what happens.

select and case

- Bash Select

```
PS3=prompt  # Special* variable for the select prompt
select choice in choices; do
        commands
        # Break, otherwise endless loop
        break
done
```

- Bash Case

```
case EXPRESSION in
    CASE1) COMMAND-LIST;;
    CASE2) COMMAND-LIST;;
    ...
    CASEN) COMMAND-LIST;;
esac
```

*see lecture 5

select/case Exercise

- Have the user select their favorite kind of music, and output a message based on their choice

select/case Exercise Solution

```
PS3="What is your favorite kind of music? "
select CHOICE in "rock" "pop" "dance" "reggae"; do
    case "$CHOICE" in
        "rock") echo "Rock on, dude.";;
        "pop") echo "Top 100 is called that for a reason.";;
        "dance") echo "Let's lay down the Persian!";;
        "reggae") echo "Takin' it easy...";;
        * ) echo "come on...you  gotta like something!";;
    esac
    break
done
```

Arrays

```
name=(element1 element2 ... elementN)

name[index]=value          # set an element
$name                      # get first element
${name[index]}             # get an element
${name[*]}                 # elements sep.by spaces
${#name[*]}                # array's length
```

- arrays don't have a fixed length; they can grow as necessary
- if you go out of bounds, shell will silently give you an empty string
  - you don't need to use arrays in assignments in this course

Functions

```
function name() {          # declaration
    commands               # ()'s are optional
}

name                       # call
```

- functions are called simply by writing their name (no parens)
- parameters can be passed and accessed as $1, $2, etc. (icky)
  - you don't need to use functions in assignments in this course

Other useful tidbits

tar files

command	description
`tar`	create or extract .tar archives (used to combine multiple files into one .tar file)

- Originally used to create "tape archive" files
- Combines multiple files into a single .tar file
- To **create** a single file from multiple files:

  `$ tar -cf filename.tar stuff_to_archive`

  - -c **creates** an archive
  - -f read to/from a file (you probably always want this option)
  - stuff_to_archive - can be a list of filenames or a directory
- To **extract** files from an archive:

  `$ tar -xf filename.tar`

  - -x **extracts** files from an archive

Compressed files

command	description
`zip, unzip`	create or extract .zip compressed archives
`gzip, gunzip`	GNU free compression programs (single-file)
`bzip2, bunzip2`	slower, optimized compression program (single-file)

- To **compress** a `file`:

  `$ gzip` ***`filename`*** produces: ***`filename.gz`***

- To **uncompress** a `file`:

  `$ gunzip` ***`filename.gz`*** produces: ***`filename`***

Similar for zip, bzip2. See man pages for more details.

.tar.gz archives

- Many Linux programs are distributed as .tar.gz archives (sometimes called .tgz)
- You could unpack this in two steps:
  1. `gzip foo.tar.gz` produces: foo.tar
  2. `tar -xf foo.tar` extracts individual files
- You can also use the tar command to create/extract compressed archive files all in one step:

```
$ tar -xzf filename.tar.gz
```

  - -x **extracts** files from an archive
  - -z filter the archive through gzip (compress/uncompress it)
  - -f read to/from a file

Handy tip: You can use the "file" command to see what type a file is, just changing the file extension on a file does not change its type.

tar examples

You can combine options (-v, -z, etc.) various ways:

Create a single .tar archive file from multiple files (without compression):

```
$ tar -cvf filename.tar stuff_to_archive
```

- -c **creates** an archive file called ***filename*.tar**
- -v verbosely list the files processed
- -f read to/from a file (as opposed to a tape archive)
- stuff_to_archive - can be filenames or a directory

Add –z option and use ***filename*.tar.gz** to use compression:

```
$ tar -cvzf filename.tar.gz stuff_to_archive
```

Single vs double quotes

- Quotes tell the shell to treat the enclosed characters as a string
- **Variable names** are not expanded in **single** quotes
  - STAR=*
    - `echo $STAR`
    - `echo “$STAR”`
    - `echo ‘$STAR’`

Shell History

- The shell remembers all the commands you've entered
- Can access them with the `history` command
- Can execute the most recent matching command with !
  - Ex: `!less` will search backwards until it finds a command that starts with `less`, and re-execute the entire command line
- Can also execute a specific command number (use numbers from the history command) with !
  - Ex: `!105` will re-execute command #105

- Remember: Up arrow will also retrieve previously used commands.

Newlines in Windows/Unix

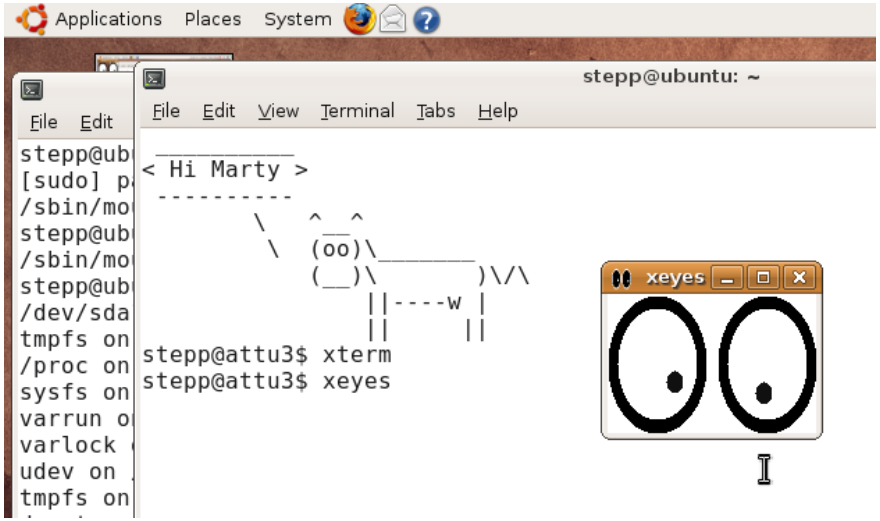
- Early printers had two different command characters:
  - Carriage return (\r) – move the print head back to the left margin
  - Line feed (\n) – move the paper to the next line
  - Both occurred when you wanted a “newline”
- As time went on, various combos were used to signify a “newline”
  - Windows typically uses the (\r\n) version
  - MacOS uses (\r)
  - Unix uses (\n)
- Can cause problems when displaying text files created on one system on another system
  - Most modern text editors recognize both and do the right thing
  - Can convert if needed:
    - **`dos2unix`** and **`unix2dos`** commands

Remote X display

Normally, you **can't** run graphical programs on **remote** servers (e.g. attu)

- however, if you connect your SSH with the -X parameter, you can!
  - the X-Windows protocol is capable of displaying programs remotely

```
ssh -X attu.cs.washington.edu
```



Then try:

`xeyes, xterm, xclock`

- Other options (-Y for "Trusted" mode, -C for compressed, see online)

Mounting cse homedir on VM

https://www.cs.washington.edu/lab/software/homeVMs/linuxVM#install

- Create a directory in your home directory, called csehomedir:
  - cd
  - mkdir csehomedir
- Now to use that directory as a “link” to your CSE files on your VM:
  - sshfs attu: ~/csehomedir

- It is a good idea to back up your files from your VM regularly.
  - Actually keep your files on your CSE home directory
  - Regularly move files from your VM to another location
  - If you need to get a fresh VM image, you can save the files from your old VM using this procedure:**"My VM Seems Broken. How Do I Recover?"**
- https://www.cs.washington.edu/lab/software/homeVMs/linuxVM#faq

Remote editing

- Gnome's file browser and `gedit` text editor are capable of opening files on a remote server and editing them from your computer
  - press Ctrl-L to type in a network location to open