
CSE 391

Lecture 6

bash scripting continued; remote X windows; unix tidbits

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<http://www.cs.washington.edu/391/>

Lecture summary

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

Exit Status

- Every Linux command returns an integer code when it finishes, called its “**exit status**”
 - 0 usually* denotes success, or an OK exit status
 - Anything other than 0 (1 to 255) usually denotes an error
- You can return an exit status explicitly using the **exit** statement
- You can check the status of the last command executed in the variable **\$?**

```
$ cat someFileThatDoesNotExist.txt
$ echo $?
1                # “Failure”
$ ls
$ echo $?
0                # “Success”
```

* One example exception: `diff` returns “0” for no differences, “1” if differences found, “2” for an error such as invalid filename argument

The test command

```
$ test 10 -lt 5
$ echo $?
1           # "False", "Failure"
$ test 10 -gt 5
$ echo $?
0           # "True", "Success"
```

- Another syntax for the test command:
Don't forget the space after [and before]

```
$ [ 10 -lt 5 ]
$ echo $?
1           # "False", "Failure"
$ [ 10 -gt 5 ]
$ echo $?
0           # "True", "Success"
```

test operators

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

```
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.

if/else

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

```
if [ condition ]; then          # if / else if / else
    commands1
elif [ condition ]; 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 *condition* space]
- include the semi-colon after] (or put “then” on the next line)

More if testing

compound comparison operators	description
<code>if [<i>expr1</i> -a <i>expr2</i>]; then ...</code> <code>if [<i>expr1</i>] && [<i>expr2</i>]; then ...</code>	and
<code>if [<i>expr1</i> -o <i>expr2</i>]; then ...</code> <code>if [<i>expr1</i>] [<i>expr2</i>]; then ...</code>	or
<code>if [! <i>expr</i>]; then ...</code>	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
```

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

safecopy Exercise

- Write a script called `safecopy` that will mimic the behavior of `cp -i` where *from* is a filename and *to* is a filename:

```
$ cp -i from.txt to.txt
```

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

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

```
$ ./bmi.sh 112 72
Your Body Mass Index (BMI) is 15
underweight
```

```
$ ./bmi.sh 208 67
Your Body Mass Index (BMI) is 32
obese
```

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 "underweight"
elif [ $BMI -le 24 ]; then
    echo "normal"
elif [ $BMI -le 29 ]; then
    echo "overweight"
else
    echo "obese"
fi
```

while and until loops

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

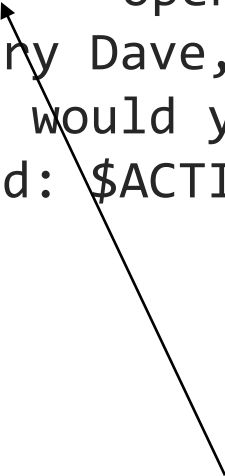
```
until [ condition ]; do    # go while condition is false
    commands
done
```

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 statement:

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

- Bash Case statement:

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

*see lecture 5

Select Example

```
PS3="What is your favorite food? " # Goes with the select stmt
```

```
echo "Welcome to the select example!"
```

```
echo "It prints out a list of choices"
```

```
echo "but does nothing interesting with the answer."
```

```
select CHOICE in "pizza" "sushi" "oatmeal" "broccoli"; do
```

```
    echo "You picked $CHOICE"
```

```
    break
```

```
done
```

```
echo "For the select statement, you pick a number as your choice."
```

Case Example

```
echo "Welcome to the case example!"  
echo "Without a select statement, you must get the spelling/case exact."  
read -p "What format do you prefer? (tape/cd/mp3/lp) " FORMAT  
echo "You said $FORMAT"
```

```
case "$FORMAT" in  
    "tape") echo "no random access!";;  
    "cd") echo "old school";;  
    "mp3") echo "how modern";;  
    "lp") echo "total retro";;  
esac
```

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

Newlines in Windows/Unix

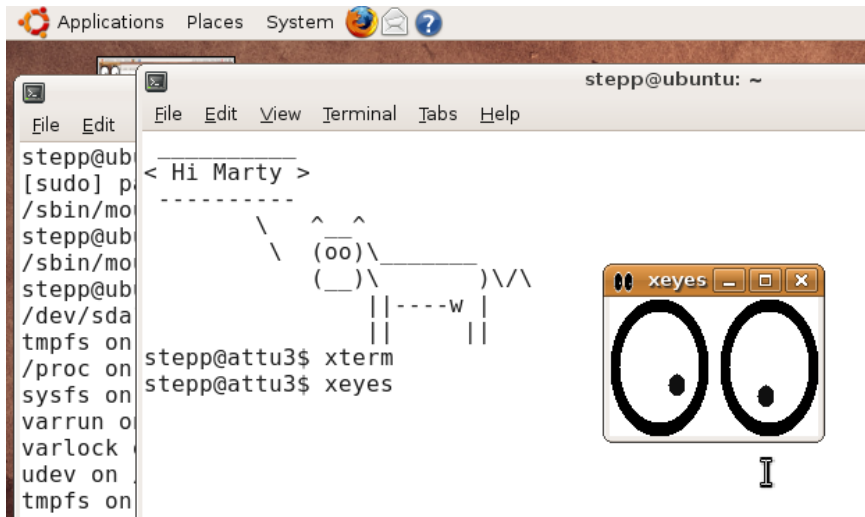
- Early printers had two different command characters:
 - Carriage return (`\r`) – move the print head back to the left margin
 - Line feed (`\n`) – move the paper to the next line
 - Both occurred when you wanted a “newline”
- As time went on, various combos were used to signify a “newline”
 - Windows 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)

Tar slides – from lecture 4

tar files

	description
tar	create or extract .tar archives (combines multiple files into one .tar file)

- Originally used to create “tape archive” files
- Combines multiple files into a single .tar file
- You probably always want to use `-f` option and **IT SHOULD COME LAST**
- 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
 - `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
```

tar

