

# 09 - Bash Scripting II

CS 2043: Unix Tools and Scripting, Spring 2016 [1]

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## Some Logistics

- All materials have been updated: > became >>>.
- Great job with HW1: only about 20 **git** mishaps I am aware of. Out of 200, that's stellar!
- Today is more scripting. The first bit was in [lec06](#).
- **VIM** will be coming back soon when we hit **ssh**...review **lec06**.
- Lecture demos 7 and 8 are up.
  - **lec07** is just a transcript of what we did at the end.
  - **lec08** is definitely worth taking a look at...**sed** is very powerful.

## Scripting Recap

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# Review I

- A script just executes from the top to the bottom.
  - Calling functions or using variables? They must be defined *first*.
- We are doing **bash**. Use the proper Shebang (**#!/bin/bash**).
- Declaring variables: cannot have spaces on side of equals signs!
  - Yes: **F00="value"**
  - No: **F00 = "value"**
- Dereference the value with the **\$** symbol.  
**>>> echo "\$F00"**
  - Note: for safety, always expand variables *inside* double quotes.**>>> echo 'Singles joining'"\$F00"' in doubles...'**
- Single quotes are the one ring to rule them all.
  - Things are read *literally*, including special symbols.**>>> echo '\$USER'**
  - Refer to [3] for more.

## Review II

- When you need to execute a command and store it in a variable, you have two options:
  - Surround it with backticks (``...cmd...``):  
`>>> VAR=`echo value``
  - Surround it with `$(...cmd...)`:  
`>>> VAR=$(echo value)`
  - Both still work, but you should prefer `$(...)` to backticks, as backticks are *deprecated*.
  - Not all commands work out as you expect. If you are not getting the results you expect, print out the variable. A bad example:

```
#!/bin/bash
STATUS=$(echo "error string" > /dev/null)
echo "$STATUS"
```

# Remember the Exit Codes

Recall from **lec04** that commands have exit codes:

- Always execute:

```
>>> cmd1; cmd2    # exec cmd1 first, then cmd2
```

- Execute conditioned upon exit code:

```
>>> cmd1 && cmd2 # exec cmd2 only if cmd1 returned 0
```

```
>>> cmd1 || cmd2 # exec cmd2 only if cmd1 returned NOT 0
```

- Kind of backwards, in terms of what means continue for *and*, but that was likely easier to implement since there is only one **0** and many **not 0**'s.
- Reference the exit code of the previous command with **\$?**

# Bash Basics

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# Arithmetic Expansion

- The shell will expand arithmetic expressions that are encased in `$(( expr ))`

```
>>> echo $((2+3)) # standard addition
5
>>> echo $((2<3)) # less than: true is 1
1
>>> echo $((2>3)) # greater than: false is 0
0
>>> echo $((2/3)) # division: BASH IS ONLY INTEGERS!!!
0
>>> x=10 # set a variable
>>> echo $((x++)) # post increment: only for variables,
10 # does it AFTER...
>>> echo "$x" # ...but see it did increment
11
>>> echo $((++x)) # pre increment: only for variables,
12 # does it BEFORE....
>>> echo "$x" # ...only one increment took place
12
>>> sum=$(( $x+10 )) # use variables like normal,
>>> echo "$sum" # note: no quotes "$x" (it is a number)
22
```

# Syntax Notes

- The Shebang does not need a space, but can have it if you want. The following all work:

```
#!/bin/bash
#! /bin/bash
#!      /bin/bash
#!      /bin/bash
```

- Just needs whitespace, the `#!` is the *magic*. Just need:
  - The `#!` to be the very first two characters, and
  - the executable separated by whitespace *on the same line*.
- In bash, you use `#` to start a comment (line / end of line that will not execute).

# Passing Arguments to Scripts

- When you pass arguments to a bash script, you can access them in a few different ways:
  - **\$1, \$2, ..., \$10, \$11**: values of the first, second, etc arguments to the script.
    - If you do not have that many arguments, the variable value is just *empty*.
  - **\$0** is the name of the script.
  - **\$#** is the number of arguments (**argc** in C).
  - **\$?** is the exit code of the last program executed.
    - You can have your script set this with **exit <number>**, read the **man** page.
  - **\$\$** is the current process identification number (PID).
  - **\$\*** expands **\$1 .. \$n** into one string.
    - **\$\*  $\implies$  "\$1 \$2 ... \$n"**
  - **@** expands **\$1 .. \$n** into individual strings.
    - **@  $\implies$  "\$1" "\$2" ... "\$n"**

# Simple Examples

```
#!/bin/bash
# File: multiply.sh
echo $(( $1 * $2 )) # print out arg1 * arg2
```

./multiply.sh 5 10

```
#!/bin/bash
# File: toLower.sh
tr '[A-Z]' '[a-z]' < $1 > $2 # read in arg1 and tr into arg2
```

./toLower.sh input\_file output\_file

```
#!/bin/bash
# File: expansion.sh
# note the use of single quotes to get a literal *
echo 'This is the *:'
for var in "$*"; do
    echo "Var: $var"
done
echo 'This is the @:'
for var in "$@"; do
    echo "Var: $var"
done
```

./expansion.sh hello there "billy bob"

# Conditonal Statements

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# If Conditionals

- If statements are structured just as you would expect...

```
if [ CONDITION_1 ]
then
    # statements
elif [ CONDITION_2 ]
then
    # statements
else
    # statements
fi # fi necessary
```

```
# The `then` is necessary...
# use a semicolon to shorten code
if [ CONDITION_1 ]; then
    # statements
elif [ CONDITION_2 ]; then
    # statements
else
    # statements
fi # fi necessary
```

- Double brackets `[[ expr ]]` allow for more features e.g. boolean operations. You generally should *always* use double brackets.

```
if [[ CONDITION_1 ]] || [[ CONDITION_2 ]]; then
    # statements
elif [[ CONDITION_3 ]] && [[ CONDITION_4 ]]; then
    # statements
else
    # statements
fi # fi necessary
```

- Note that you need spaces before and after the brackets!!!

# Test Expressions

- Bash has a special set of commands that allow various checks.
- Numerical comparisons (often used with variables):
  - `n1 -eq n2` tests if  $n1 = n2$ .
  - `n1 -ne n2` tests if  $n1 \neq n2$ .
  - `n1 -lt n2` tests if  $n1 < n2$ .
  - `n1 -le n2` tests if  $n1 \leq n2$ .
  - `n1 -gt n2` tests if  $n1 > n2$ .
  - `n1 -ge n2` tests if  $n1 \geq n2$ .
  - If either `n1` or `n2` are not a number, the test fails.
- String comparisons:
  - `s1 == s2` tests if `s1` and `s2` are identical.
  - `s1 != s2` tests if `s1` and `s2` are different.
  - Make sure you have spaces!
    - `s1==s2` will *fail*...

- If **path** is a string indicating a path, we can test its validity and attributes:
  - **-e path** tests if **path** exists.
  - **-f path** tests if **path** is a file.
  - **-d path** tests if **path** is a directory.
  - **-r path** tests if you have permission to read the file.
  - **-w path** tests if you have write permission.
  - **-x path** tests if you have execute permission.
  - **-s path** tests if the file is empty.
  - There are many of these, refer to [2] for more.



# Loops

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# For Loops

```
for var in s1 s2 s3; do  
    cmd1  
    cmd2  
done
```

```
for var in {000..22}; do  
    cmd1  
    cmd2  
done
```

```
for (( i = 0; i < 10; i++ )); do  
    cmd1  
    cmd2  
done
```

# While Loops

```
while [[ condition ]]; do
    cmd1
    cmd2
done
```

```
FILE="filename.txt"
while read line; do
    cmd1
    cmd2
done < "$FILE"
```

```
FILE="filename.txt"
for line in $(cat "$FILE"); do # NEVER DO THIS
    cmd1
    cmd2
done
```

## References I

- [1] B. Abrahao, H. Abu-Libdeh, N. Savva, D. Slater, and others over the years.

**Previous cornell cs 2043 course slides.**

- [2] TLDP.

**Introduction to if.**

[http://tldp.org/LDP/Bash-Beginners-Guide/html/sect\\_07\\_01.html#sect\\_07\\_01\\_01](http://tldp.org/LDP/Bash-Beginners-Guide/html/sect_07_01.html#sect_07_01_01).

- [3] H. to Geek.

**What's the difference between single and double quotes in the bash shell?**

<http://www.howtogeek.com/howto/29980/whats-the-difference-between-single-and-double-q>

