
CSE 391

Lecture 5

Intro to shell scripting

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

Lecture summary

- basic script syntax and running scripts
- shell variables and types
- control statements: the for loop

Shell scripts

- **script:** A short program meant to perform a targeted task.
 - a series of commands combined into one executable file
- **shell script:** A script that is executed by a command-line shell.
 - bash (like most shells) has syntax for writing script programs
 - if your script becomes > ~100-150 lines, switch to a real language
- To write a bash script (in brief):
 - type one or more commands into a file; save it
 - type a special header in the file to identify it as a script (next slide)
 - enable execute permission on the file
 - run it!

Basic script syntax

#! *interpreter*

- written as the first line of an executable script; causes a file to be treated as a script to be run by the given interpreter
 - (we will use `/bin/bash` as our interpreter)
- Example: A script that removes some files and then lists all files:

```
#!/bin/bash  
rm output*.txt  
ls -l
```

Running a shell script

- by making it executable (most common; recommended):

```
chmod u+x myscript.sh
```

```
./myscript.sh
```

- fork a process and run commands in `myscript.sh` and exit

- by launching a new shell :

```
bash myscript.sh
```

- advantage: can run without execute permission (still need read permission)

- by running it within the current shell:

```
source myscript.sh
```

- advantage: any variables defined by the script remain in this shell (more on variables later)

echo

command	description
echo	produces its parameter(s) as output (the println of shell scripting) -n flag to remove newline (print vs println)

- Example: A script that prints your current directory.

```
#!/bin/bash
echo "This is my amazing script!"
echo "Your current dir is: `pwd`"
```

- *Exercise* : Write a script that when run on attu does the following:
 - clears the screen
 - displays the current date/time
 - Shows who is currently logged on & info about processor

Script example

```
#!/bin/bash
clear          # please do not use clear in your hw scripts!
echo "Today's date is `date`"
echo

echo "These users are currently connected:"
w -h | sort
echo

echo "This is `uname -s` on a `uname -m` processor."
echo

echo "This is the uptime information:"
uptime
echo
echo "That's all folks!"
```

Comments

`# comment text`

- bash has only single-line comments; there is no `/* ... */` equivalent
- Example:

```
#!/bin/bash
# Leonard's first script ever
# by Leonard Linux
echo "This is my amazing script!"
echo "The time is: `date`"

# This is the part where I print my current directory
echo "Current dir is: `pwd`"
```


Shell variables

- ***name=value*** *(declaration)*
 - must be written ***EXACTLY*** as shown; no spaces allowed
 - often given all-uppercase names by convention
 - once set, the variable is in scope until unset (within the current shell)

```
AGE=64
```

```
NAME="Michael Young"
```

- ***\$name*** *(usage)*

```
echo "$NAME is $AGE years old"
```

Produces:

```
Michael Young is 64 years old
```

Common errors

- if you misspell a variable's name, a new variable is created

```
NAME=Ruth
```

```
...
```

```
Name=Rob # oops; meant to change NAME
```

- if you use an undeclared variable, an empty value is used

```
echo "Welcome, $name" # Welcome,
```

- when storing a multi-word string, must use quotes

```
NAME=Ruth Anderson # Won't work
```

```
NAME="Ruth Anderson" # $NAME is Ruth Anderson
```

More Errors...

- Using \$ during assignment or reassignment
 - `$mystring="Hi there" # error`
 - `mystring2="Hello"`
 - ...
 - `$mystring2="Goodbye" # error`
- Forgetting echo to display a variable
 - `$name`
 - `echo $name`

Capture command output

variable=`*command*`

- captures the output of *command* into the given variable
- Note – this is `back ticks` (not 'single quotes' – see next slide)

- Simple Example:

```
FILE=`ls *.txt`  
echo $FILE
```

- More Complex Example:

```
FILE=`ls -1 *.txt | sort | tail -1`  
echo "Your last text file is: $FILE"
```

- What if we use double quotes instead?

Double vs. Single quotes

Double quotes - Variable names are expanded & Back ticks work

```
NAME="Bugs Bunny"  
echo "Hi $NAME! Today is `date`"
```

Produces:

```
Hi Bugs Bunny! Today is Tues Apr 26 13:37:45 PDT 2016
```

Single quotes – don't expand variables or execute commands in Back ticks

```
echo 'Hi $NAME! Today is `date`'
```

Produces:

```
Hi $NAME! Today is `date`
```

Tricky Example:

- STAR=*
 - echo "You are a \$STAR"
 - echo 'You are a \$STAR'
 - echo You are a \$STAR

Lesson: When referencing a variable, it is good practice to put it in double quotes.

Types and integers

- most variables are stored as strings
 - operations on variables are done as string operations, not numeric
- to instead perform integer operations:
x=42
y=15
let z="\$x + \$y" # 57
- integer operators: + - * / %
 - bc command can do more complex expressions
- if a non-numeric variable is used in numeric context, you'll get 0

Bash vs. Java

Java	Bash
<code>String s = "hello";</code>	<code>s=hello</code>
<code>System.out.println("s");</code>	<code>echo s</code>
<code>System.out.println(s);</code>	<code>echo \$s</code>
<code>s = s + "s";</code> // "hellos"	<code>s=\${s}s</code>
<code>String s2 = "25";</code> <code>String s3 = "42";</code> <code>String s4 = s2 + s3;</code> // "2542" <code>int n = Integer.parseInt(s2)</code> <code> + Integer.parseInt(s3);</code> // 67	<code>s2=25</code> <code>s3=42</code> <code>s4=\$s2\$s3</code> <code>let n="\$s2 + \$s3"</code>

x=3

- x vs. \$x vs. "\$x" vs. '\$x' vs. \'\$x\' vs. 'x'

Special variables

variable	description
\$DISPLAY	where to display graphical X-windows output
\$HOSTNAME	name of computer you are using
\$HOME	your home directory
\$PATH	list of directories holding commands to execute
\$PS1	the shell's command prompt string
\$PWD	your current directory
\$SHELL	full path to your shell program
\$USER	your user name

- these are automatically defined for you in every bash session
- *Exercise* : Change your attu prompt to look like this:
jimmy@mylaptop:\$
 - See `man bash` for more info (search on PROMPTING)

\$PATH

- When you run a command, the shell looks for that program in all the directories defined in \$PATH
- Useful to add commonly used programs to the \$PATH
- Exercise: modify the \$PATH so that we can directly run our shell script from anywhere
 - echo \$PATH
 - PATH=\$PATH:/homes/iws/rea
- What happens if we clear the \$PATH variable?

set, unset, and export

shell command	description
set	sets the value of a variable (not usually needed; can just use x=3 syntax)
unset	deletes a variable and its value
export	sets a variable and makes it visible to any programs launched by this shell
readonly	sets a variable to be read-only (so that programs launched by this shell cannot change its value)

- typing set or export with no parameters lists all variables
- *Exercise:* set a local variable, and launch a new bash shell
 - Can the new shell see the variable?
 - Now go back and export and launch a shell again. Can you see it now?

Console I/O

shell command	description
read	reads value from console and stores it into a variable
echo	prints output to console
printf	prints complex formatted output to console

- variables read from console are stored as strings
- Example:

```
#!/bin/bash
read -p "What is your name? " name
read -p "How old are you? " age
printf "%10s is %4s years old" $name $age
```

Command-line arguments

variable	description
<code>\$0</code>	name of this script
<code>\$1, \$2, \$3, ...</code>	command-line arguments
<code>\$#</code>	number of arguments
<code>\$@</code>	array of all arguments

- Example.sh:

```
#!/bin/bash
echo "Name of script is $0"
echo "Command line argument 1 is $1"
echo "there are $# command line arguments: $@"
```

- Example.sh argument1 argument2 argument3

for loops

```
for name in value1 value2 ... valueN; do  
    commands  
done
```

- Note the semi-colon after the values!
- the pattern after `in` can be:
 - a hard-coded set of values you write in the script
 - a set of file names produced as output from some command
 - command line arguments: `$@`
- *Exercise*: create a script that loops over every `.txt` file in the directory, renaming the file to `.txt2`

```
for file in *.txt; do  
    mv $file ${file}2  
done
```

for loop examples

```
for val in red blue green; do
    echo "val is: $val"
done
```

```
for val in $@; do
    echo "val is: $val"
done
```

```
for val in `seq 4`; do
    echo "val is: $val"
done
```

command	description
seq	outputs a sequence of numbers

Exercise

- Write a script `createhw.sh` that creates directories named `hw1`, `hw2`, ... up to a maximum passed as a command-line argument.

```
$ ./createhw.sh 8
```

- Copy `criteria.txt` into each assignment i as `criteria(2*i).txt`
- Copy `script.sh` into each, and run it.
 - output: Script running on `hw3` with `criteria6.txt` ...

Exercise solution

```
#!/bin/bash
# Creates directories for a given number of assignments.

for num in `seq $1`; do
    let CRITNUM="2 * $num"
    mkdir "hw$num"
    cp script.sh "hw$num/"
    cp criteria.txt "hw$num/criteria$CRITNUM.txt"
    echo "Created hw$num."
    cd "hw$num/"
    bash ./script.sh
    cd ..
done
```