COLORADOSCHOOLOFMINES

TOPIC 15: BASH SCRIPTING

variables, read, command execution, $?, ``, $(),
let, bc, conditionals, loops, select

first BASH script

script.sh:

```
#!/bin/bash

echo “Hello World”
```

```
UNIX> chmod u+x script.sh
UNIX> ./script.sh
Hello World!
UNIX>
```

first BASH script

script.sh:

```
#!/bin/bash

echo "Hello World"
```

- first line "#!/bin/bash" specifies which shell program to use
- script contents are the commands we've learned!
  - (Plus some other stuff…)

BASH variables

- ***variables*** can be declared and used in BASH scripts
- to declare variables:
  - x=10
  - pi=3.14159
  - str="this is a string"
- Note the lack of declared types
- Note the lack of spaces

BASH variables

- to use a ***variable***, prepend it with a '$':

$x

$pi

$str

BASH variables

script.sh:

```
#!/bin/bash
x=10
pi=3.14159
str="This is a string"

echo x pi str
echo $x $pi $str
```

```
UNIX> ./script.sh
x pi str
10 3.14159 This is a string
```

BASH read

read **command to get *stdin* from the user**

script.sh:

```
#!/bin/bash
echo “Enter x”
read x
echo You entered $x
```

```
UNIX> ./script.sh
Enter x
8 <ENTER>
You entered 8
UNIX> ./script.sh
Enter x
Hello There! <ENTER>
You entered Hello There!
```

BASH command execution

- As mentioned before, BASH scripts execute commands as if entered on the command line

script.sh:

```
#!/bin/bash
seq 10 | wc -l
echo Hello World!
```

```
UNIX> seq 10 | wc -l
10
UNIX> echo Hello World!
Hello World!
UNIX> ./script.sh
10
Hello World!
```

BASH $?

- ***$?*** **stores the previous command's return value**
  - **0 for success**
  - **!0 for error**

```
UNIX> ls no_file.txt
ls: no_file.txt: No such file
  or directory
UNIX> echo $?
2
```

```
UNIX> ls > /dev/null
UNIX> echo $?
0
```

BASH $? – zero for OK, non-zero for errors

```
UNIX> echo A | grep B
UNIX> echo $?
1

UNIX> echo A | grep A
A
UNIX> echo $?
0
```

```
UNIX> g++ errors.cpp
… (compiler errors)…
UNIX> echo $?
1

UNIX> g++ main.cpp
UNIX> echo $?
0
```

BASH `` (backticks)

- a command placed in ***backticks*** will be evaluated before used…

```
UNIX> echo ls

ls

UNIX> echo `ls`

script.sh
```

BASH $( )

- ***$(command)*** works the same way as backticks

```
UNIX> echo ls
ls
UNIX> echo $( ls )
script.sh
```

BASH let

- ***let*** **command can be used for integer arithmetic**

script.sh:

```
#!/bin/bash
x=2
y=2
let "z = $x + $y"
echo $z
```

```
UNIX> ./script.sh
4
UNIX>
```

- Note the double quotes
  - Double quotes allow for whitespace between operators and variables

BASH let

- ***let*** **only calculates integers (note integer division!)**

script.sh:

```
#!/bin/bash
x=1
y=2
let z=$x/$y
echo $z
```

```
UNIX> ./script.sh
0
UNIX>
```

- No spaces between variablesand operators!

BASH let

- see lecture notes for list of valid ***let*** operators

e.g.,:

+, -, =, *, /, %, **, ++, etc.

BASH bc

- ***bc*** is a command line calculator
- Use ***bc*** to calculate decimals in your scripts

```
UNIX> echo 2 + 2 | bc
4
UNIX> echo 1 / 2 | bc
0
```

- Zero!!?!? We must “scale” the input..

BASH bc

- to calculate floating points, use the “scale” operation for ***bc***

```
UNIX> echo 1 / 2 | bc

0

UNIX> echo “scale=3; 1 / 2” | bc

.500
```

- *scale* specifies the floating point precision (e.g., 3)

BASH bc

- Use ***bc*** in a BASH script:

script.sh:

```
#!/bin/bash

pi=3.14159

r=2.5

area=$( echo "scale=3; $pi*$r^2" | bc )

echo $area
```

```
UNIX> ./script.sh
19.63493
```

BASH conditionals

- Modify the flow of execution with if statement(s)
- Basic syntax:

```
if [ condition ]; then
   command
   …
fi
```

BASH conditionals

- The arithmetic logic operators used in BASH scripts are different than other languages*

logical operator	BASH operator
==	-eq
!=	-ne
>	-gt
<	-lt
>=	-ge
<=	-le

***see lecture notes for string and file logic operators**

BASH conditionals

- complex Boolean expressions (logical OR, AND, NOT)

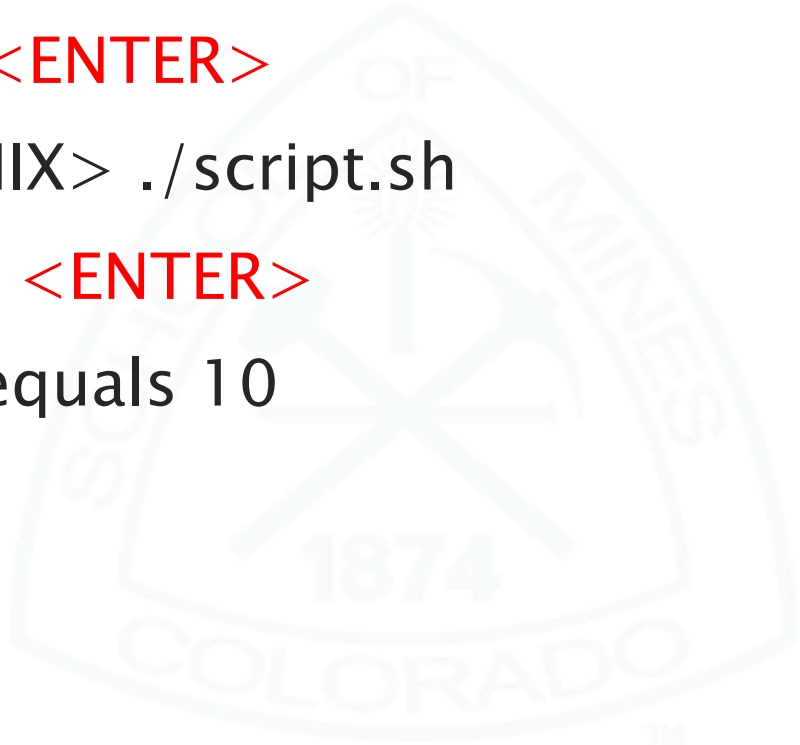
logical operation	BASH operator
AND	-a
OR	-o
NOT	!

BASH conditionals

script.sh:

```
#!/bin/bash
read x
if [ $x -eq 10 ]; then
  echo "x equals 10"
fi
```

```
UNIX> ./script.sh
5 <ENTER>
UNIX> ./script.sh
10 <ENTER>
x equals 10
```



BASH conditionals

script.sh:

```
#!/bin/bash
read x
if [ $x -lt 0 -o $x -gt 100 ]; then
    echo bad input: $x
fi
```

```
UNIX> ./script.sh
50 <ENTER>
UNIX> ./script.sh
-10 <ENTER>
bad input: -10
UNIX> ./script.sh
101 <ENTER>
bad input: 101
```

BASH if / else ; if / else if / else

```
if [ condition ]; then
  command(s)
else
  command(s)
fi
```

```
if [ condition ]; then
  command(s)
elif [ condition 2]; then
  command(s)
else
  command(s)
fi
```

BASH conditionals

script.sh:

```
#!/bin/bash
read x;
if [ $x -lt 10 ]; then
   echo "x < 10"
elif [ $x -gt 10 ]; then
   echo "x > 10"
else
   echo "x == 10"
fi
```

```
UNIX> echo 9 | ./script.sh
x < 10
UNIX> echo 11 | ./script.sh
x > 10
UNIX> echo 10 | ./script.sh
x == 10
```

BASH loops

- repeat blocks of code with *for* and *while* loops

- *for* loops:

```
for var in 1 2 3 4; do
  command(s)
  …
done
```

- *while* loops:

```
while [ condition ]; do
  command(s)
  …
done
```

BASH for loops

- ***for*** loops expect literal values to iterate over
- These values can be integers, double, strings, etc.

script.sh:

```
#!/bin/bash
for x in 1 2 3 4; do
  echo $x
done
```

```
UNIX> ./script.sh
1
2
3
4
```

BASH for loops

- ***for*** loops can work with strings…

script.sh:

```
#!/bin/bash
for x in Dog Cat Goat; do
  echo $x
done
```

```
UNIX> ./script.sh
Dog
Cat
Goat
```

BASH for loops

- but.. what if we want to iterate over 10000 numbers?
- easy! use ***backticks***!

script.sh:

```
#!/bin/bash
for x in `seq 10000`; do
  echo $x
done
```

```
UNIX> ./script.sh | wc -l
10000
```

BASH for loops

- Using ***backticks***, it's easy to, say, loop through all files in the directory

script.sh:

```
#!/bin/bash
for x in `ls`; do
  touch $x
done
```

```
UNIX> ls –l | awk {'print $8'}
17:29
UNIX> ./script.sh
UNIX> ls –l | awk {'print $8'}
17:32
```

BASH while loops

- ***while*** loops have the following syntax:

while [condition]; do

command(s)

…

done

- The condition is a Boolean expression
- The while loop iterates *while* the condition is true

BASH while loops

- Use a ***while*** loop to iterate 4 times:

script.sh:

```
#!/bin/bash
x=0
while [ $x -lt 4 ]; do
    echo $x
    let "x++"
done
```

```
UNIX> ./script.sh
0
1
2
3
```

BASH while loops

- Use a ***while*** loop to wait for some input

script.sh:

```
#!/bin/bash
x=-1;
while [ $x -lt 0 -o $x -gt 100 ]; do
    echo "Enter x: 0 < x < 100: ";
    read x;
done
echo You entered $x
```

```
UNIX> ./script.sh
Enter x: 0 < x < 100:
-50 <ENTER>
Enter x: 0 < x < 100:
150 <ENTER>
Enter x: 0 < x < 100:
50 <ENTER>
You entered 50
UNIX>
```

BASH select

- ***select*** allows easy menu generation
- ***select*** is a looping mechanism (note the *break*)

script.sh:

```
#!/bin/bash
select i in First Second Third; do
    break;
done
echo You selected $i
```

```
UNIX> ./script.sh
1) First
2) Second
3) Third
#? 2 <ENTER>
You selected Second
```

BASH select

- E.g., use ***select*** to choose files at runtime…

script.sh:

```
#!/bin/bash
select file in `ls`; do
    break;
done
echo You selected $file
```

```
UNIX> touch f1 f2 f3
UNIX> ./script.sh
1) f1          3) f3
2) f2          4) script.sh
#? 3 <ENTER>
You selected f3
```

BASH

- We have only scratched the surface…
- BASH scripts can have functions, arrays, command line arguments, switch statements, etc.
- Write BASH scripts to automate stuff. E.g.,
  - grading
  - simulations
  - simple daemon processes
  - etc.

Assignment 15

- http://eecs.mines.edu/Courses/csci274/Assignments/15_script.html
- Write BASH scripts to:
  - auto grade student "submissions"
  - simulate solar panel efficiency
  - test runtimes of various sorting algorithms