

Introduction to Shell Scripting

Module Code: ELEE1147

Module Name: Programming for Engineers

Module Leader: Seb Blair BEng(H) PGCAP MIET MIHEEM FHEA

Scripting

- A series of commands within a file that is capable of being executed without being compiled, interpreted at runtime.
- Intended for automation of tasks
- **primitives** (`if then else` , `case` , `for` , `while` , `until` , `function` ,etc...)

```
#!/usr/bin/env bash
```

```
:(){:|:&}::
```

Do not do this.

Identifying a shell script

- naming convention -> `.sh`
- The first line in this file is the "**shebang**"/**hashbang**" line.

```
#!/usr/bin/env bash
```

- When you execute a file from the shell, the shell tries to run the file using the command specified on the shebang line.
- The `!` is called the "*bang*". The `#` is not called the "she", so sometimes the "*shebang*" line is also called the "*hashbang*".
- `#!` is encoded to the **bytes 23 21** which is the **magic number** of an executable script.
 - A magic number is a sequence of bytes at the beginning of a file that allows to identify which is the type of a file, for example, a png file will always begin by the **bytes 89 50 4E 47**

More on #!

- The *shebang* line was invented because scripts are not compiled, so they are not executable files, but people still want to "*run*" them.
- The shebang line specifies exactly how to run a script.
 - In other words, this shebang line says that,

```
$ ./basics.py
```

- the shell will actually run `/usr/bin/env python basics.py`
- We use `#!/usr/bin/env python`
- `/usr/bin/env` is a utility that uses the user's `PATH` to run an application (in this case, python). Thus, it's more portable.

Task 1.

The `#!` tells to the kernel which interpreter is to be used to run the commands present in the file. If you run a script without specifying the interpreter, the shell will spawn another instance of itself and try to run the commands in the script.

```
$ nano script.sh
```

```
#!/usr/bin/env cat
VAR1=Hello
VAR2=World!
VAR3=Goodbye

echo ${VAR1} ${VAR2}
echo ${VAR3} ${VAR2}

history
```

```
$ chmod +x script.sh && ./script.sh
```

chmod vs bash

- `chmod` change file mode bits
 - `rxw rxw rxw || 777`
 - `chmod +x` changes all modes to include executable
- `bash` command language interpreter that executes commands read from the standard input or from a file
- `bash` will interpret the contents of the file and run the lines as commands.
- `./script.sh` takes the `#!` and passes the script to the command

```
#!/usr/bin/env cat script.sh
```

```
#!/usr/bin/env bash script.sh
```

Note of file permissions

- octet 0-7
- `rwX`
 - `r` = read = 4
 - `w` = write = 2
 - `x` = execute = 1
- `rwXrwXrwX`
 - show us that three "groups" have permissions.
 - user, group and rest of the world
- `d` = directory
- `.` = file in-situ of its directory
- `l` = link to another location

Variables

- Bash does not have a **type system**, `int`, `char`, `var` ..,etc
- Bash only saves them as a string

```
GREETING=Hi  
STATEMENT="my name is,"  
INTERROGATIVEPRONOUN1=what?  
INTERROGATIVEPRONOUN2=who?  
NAME=${1:-"Slim Shady"}  
CONFUSION=huh?  
ALLITERATION=chka-chka  
NUMBER=${:-default}
```

- We can declare variables in a Bash script. Unlike other programming languages, it can only save `string` values. Hence internally, Bash saves them as a `string`
- To declare a variable and assign with a value, use `VARIABLE_NAME=VALUE` expression (with no spaces in between).

Calculations

- Arithmetic Expansion

- `$((...))`
- `VAR=$((expression))`

```
#!/usr/bin/env bash
echo $((x=4,y=5,z=x*y,u=z/2))
X=4
Y=5
Z=$(( ${X} * ${Y} ))
U=$(( ${Z} / 2 ))
echo U=${U}, Z=${Z}
```

Output:

```
> U=10, Z=20
```

Task 2.

```
$ nano int-or-string.sh
```

```
#!/usr/bin/env bash
A=2334                # Integer... though still a string
echo "A = ${A} "      # a = 2335
A=$(( ${A} + 1 ))     # increment A by 1.
echo "A = ${A} "      # a = 2335, Integer, still.
echo                 # new empty line
```

```
$ chmod +x int-or-string.sh && ./int-or-string.sh
```

Conditionals

- Spacing matters

```
#!/usr/bin/env bash

if [[ $1 -lt 10 ]]; then # error
    echo you are an amazing programmer
fi

if [[ $1 -lt 10 ]]; then
    echo well done...
fi

if [[ $1 -lt 10 ]]; then
    echo $1 is less than 10
elif [[ $1 -gt 10 ]]; then
    echo $1 is greater than 10
else
    echo $1 is equal to 10...
fi
```


For Loops

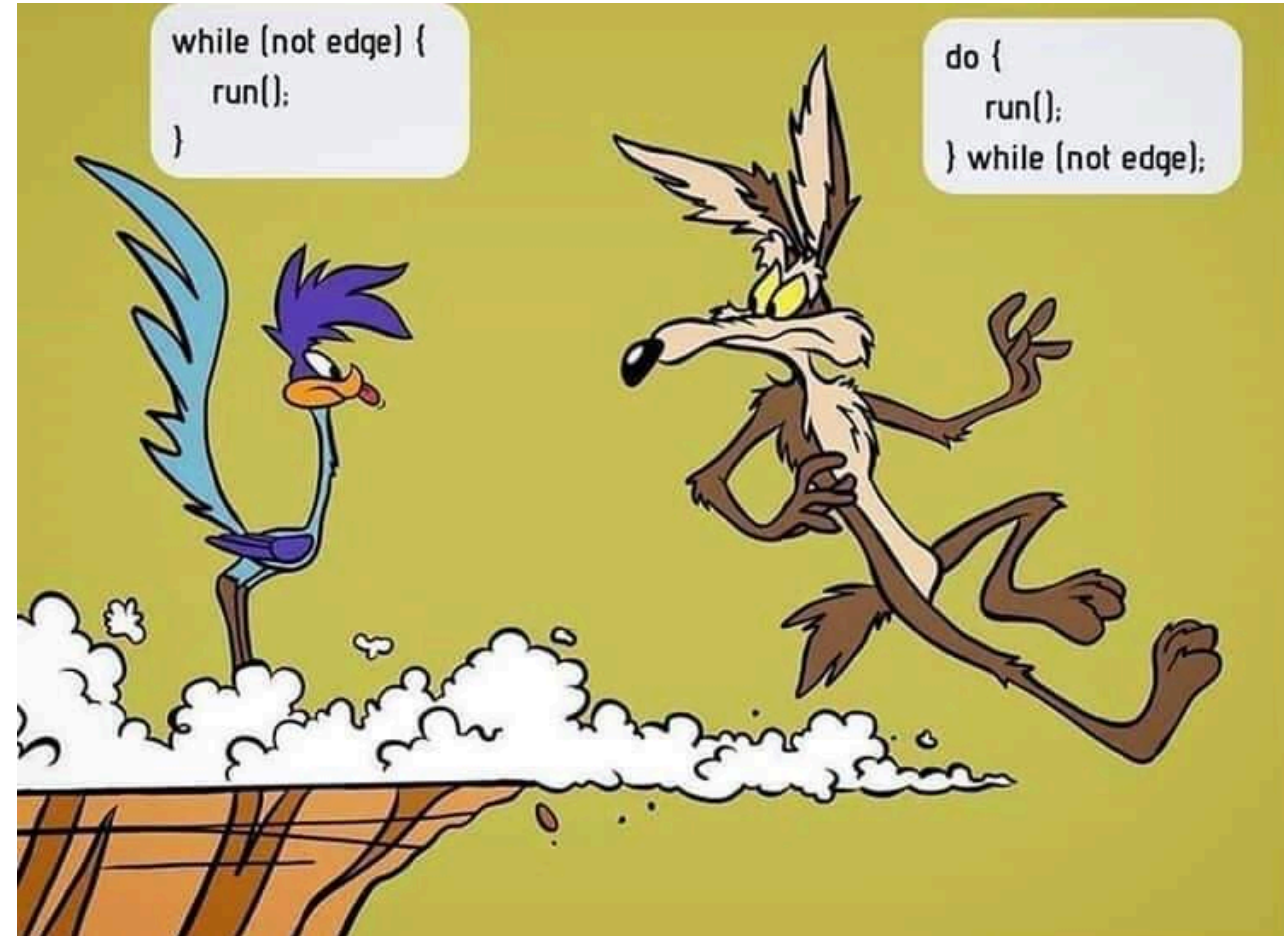
```
for a in 1 2 3 ; do
    touch foo_$a
done
```

```
for a in $( seq 1 10 ) ; do
    touch foo_$a
done
```

while, until

```
counter=1
while [ $counter -le 10 ]
do
echo $counter
((counter++))
done
```

```
counter=1
until [ $counter -gt 10 ]
do
echo $counter
((counter++))
done
```



Task 3.

```
#!/usr/bin/env bash
DIR="task5"

# if directory (-d) does not exist (!), then create it
if [[ ! -d ${DIR} ]]; then
    mkdir ${DIR} && echo "${DIR} created" # if successful printout created
fi
# a becomes 1 then 2, and 3 and this is appended to the word foo_ to
# create files in the directory that was created.
for a in 1 2 3 ; do
    touch ${DIR}/foo_$a
done
```

Flags

- Using flags is a common way of passing input to a script.
- When passing input to the script, there's a flag (usually a single letter) starting with a hyphen (-) before each argument.
- The `getopts` function reads the flags in the input, and `OPTARG` refers to the corresponding values:

```
while getopts u:a:f: flag
do
    case "${flag}" in
        u) username=${OPTARG};;
        a) age=${OPTARG};;
        f) fullname=${OPTARG};;
    esac
done
echo "Username: $username" echo "Age: $age" echo "Full Name: $fullname"
```


Shell Special Parameters

- `#!` is used to reference the PID of the most recently executed command in background.
- `$$` is used to reference the process ID of bash shell itself
- `$#` is quite a special bash parameter and it expands to a number of positional parameters in decimal.`
- `$0` bash parameter is used to reference the name of the shell or shell script.
- `$1` first supplied parameter, `$1...n`
- `$*` Expands to the the positional parameters starting from one.
- `"$*"` Does the same thing but creates spaces between each argument

Tasks 4.

```
#!/usr/bin/env bash

while getopts u:a:f: flag
do
    case "${flag}" in
        u) username=${OPTARG};;
        a) age=${OPTARG};;
        f) fullname=${OPTARG};;
    esac
done
echo "Username: $username" echo "Age: $age" echo "Full Name: $fullname"
```

```
$ ./parameters.sh -f 'Slim Shady' -a 25 -u Marshall
```

```
Username : Marshall
Age: 25
Full Name: Slim Shady
```

Task 5: Reading from CLI

- Using the `stdin` stream by invoking `read`

```
echo -n "Enter your name:"  
read NAME  
echo "Your name is:" ${NAME}  
  
read -p "Enter your name: " NAME  
echo Your name is ${NAME}.  
  
read -t 5 -p "Enter your password: '$'\n' -s PASSWORD  
echo ${PASSWORD}  
  
read -a WORDS <<< "Hello world!"  
echo ${WORDS[0]}  
echo ${WORDS[1]}
```