# Lecture 5 – Shell programming

# **Learning Objectives:**

- 2. Become familiar with the use of Bash, shell programming, and console editors
  - 2.7 Understand the use of environment-setting shell files.
  - 2.8 Understand the syntax of flow control elements.
  - 2.9 Learn the variable naming conventions of Bash.
  - 2.10 Produce shell scripts.
- 4. Produce code that is reproducible and produces results that are replicable.
  - 4.5 Use scripts to make command-line functions reproducible.

Announcement: Pick an R package to present during class 9/23 & 9/28!

## **Your Bash Shell**

#### Two types of Shells: login and non-login

- Login shell: for interactive instances (mostly)
  - logs in with /bin/login and /etc/profile.d/
  - will read in ~/.bash\_profile instead of ~/.bashrc by default
  - most instances of Terminal, other prompt-type interfaces
  - When tested with echo \$0 should return -bash
- Non-login shell: started by a program without a login, by just passing the name of the shell
  - will call ~/.bashrc but not ~/.bash\_profile
  - ~/.bashrc (if it exists) will call /etc/profile.d/
  - mostly called by executed scripts

## Your Bash Shell

#### Setting your .bash\_profile

- Purpose: configure your personal shell environment
- Location: in home directory, hidden file
- put this in .bash\_profile to ensure that you have the same working environment in your login and nonlogin shells:

```
if [ -f ~/.bashrc ]; then . ~/.bashrc; fi
```

 setting aliases: this is really helpful for creating shortcuts to common locations and programs

```
alias matlab="/Applications/MATLAB_R2019a.app/bin/matlab
-nodisplay -nosplash -nodesktop"

alias gobox="cd '/Users/waldrop/Dropbox (Chapman)/'"
```

after making changes, don't forget to source it to load those new commands:
 source ~/.bash\_profile

# **Your First Bash Script**

#### **Create a script file:**

\$ touch helloworld.sh

#### In console editor:

```
#!/bin/bash

#Prints 'Hello world'
echo Hello world
```

#### Run the script:

\$ sh helloworld.sh

#### Make the script executable, then run:

- \$ chmod +x helloworld.sh
- \$ ./helloworld.sh

#### Why use scripts?

- You can look at it without running it
- Can be run by you or anyone else
- Makes your analysis reproducible!!

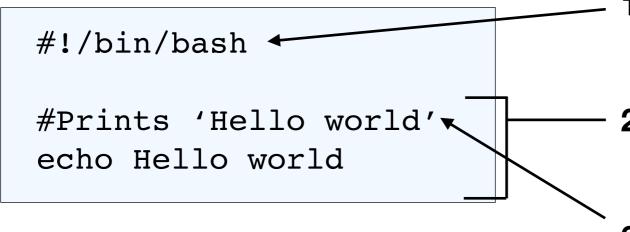
# **Your First Bash Script**

#### **Create a script file:**

\$ touch helloworld.sh

#### Parts of a shell script:

#### In console editor:



- Hashbang tells shell how to interpret commands
- 2. Contents Content of script (from Bash shell)
- 3. Comments begin with pound.

#### Run the script:

\$ sh helloworld.sh

#### Make the script executable, then run:

- \$ chmod +x helloworld.sh
- \$ ./helloworld.sh

# **Your Second Bash Script**

Group work: Make a script of the NW1 exercise from last class.

#### **Set** a variable:

\$ X=lobster

#### Call a variable:

\$ echo \$X

\$ echo "\$X"

\$ echo \${X}

#### NOT:

\$ echo X

\$ echo '\$X'

# Curly brackets and backslashes help define names:

\$ echo \${X}\_file

\$ echo \$X\\_file

#### NOT:

\$ echo \$X\_file

**Concept check:** Add a variable to your helloworld.sh script and have it print the variable out!

#### Use externally define variable: positional parameters

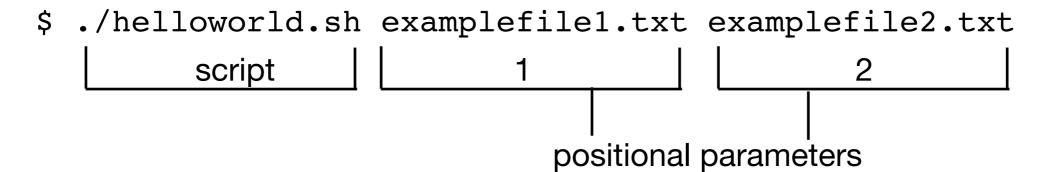
```
#!/bin/bash

#Prints 'Hello world'
echo Hello world

File=$1
cat $File
```

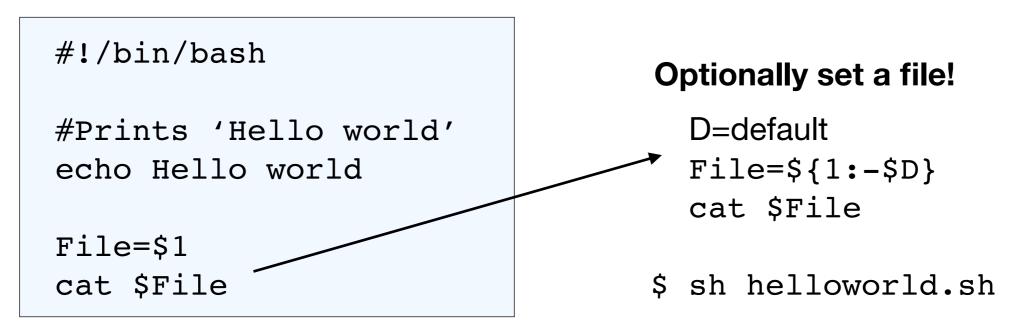
\$ sh helloworld.sh examplefile.txt

or



Concept check: Try a few other text files as positional parameters.

#### Use externally define variable: positional parameters



See link "parameter expansion"!

\$ sh helloworld.sh examplefile.txt

or

\$ ./helloworld.sh examplefile1.txt examplefile2.txt

script

1
2

**Concept check:** How could you return an error message if the script is given no argument?

positional parameters

#### **Setting patterns within bash variable names:**

```
${var*pattern} removes pattern from end of variable
$ F=file.100
$ echo ${F*.100} \top file

$ {var*pattern} removes pattern from beginning of variable

$ F=file.100
$ echo ${F#file.} \top 100

$ F="git-practice-repo/practicefiles/file.100"
$ echo ${F#**/} \top file.100
```

**Concept check:** For the last example, write an echo command to return the directory name *only*: git-practice-repo, practice files.

# **Your Second Bash Script**

**Group work:** Make a script of the NW1 exercise from last class.

**Group work:** For your NW1 script, now make it so you add the file to be split as a positional parameter and it automatically splits the two files. Note that none of the line numbers can be hard coded (or coded directly as numbers in the script), they should be calculated within the program!

# Flow Control in Bash: conditionals

#### If/then/else statement:

```
#!/bin/bash

#Prints 'Hello world'
echo Hello world

File=${1:2No parameter provided}
if [ $File = "example.txt" ]; then
        echo "Here is the text..."
        cat $File
else
        echo "You must use example.txt"
fi
```

These spaces are important!!

statement to evaluate what to do if true

what to do if false

#### Run the script:

```
$ sh helloworld.sh example.txt
```

#### Add additional conditions with else if:

```
elif [ $File = "hesam.txt" ]; then
  echo "This is a good file."
  cat $File
```

put between if and else

# Flow Control in Bash: conditionals

#### **In-line conditionals:**

```
statement 1 && statement 2 runs statement 2 if statement 1 succeeds statement 1 | | statement 2 runs statement 2 if statement 1 fails
```

## Flow Control in Bash: conditionals

**Group work:** Make a short script named "noises.sh". The input should be from the command line as a positional parameter and should take animal names. Make the output follow these rules:

Horses go "neigh", ducks go "quack", dogs go "woof", cats go "meow"

What if I give the argument "Fox"?

https://www.youtube.com/watch?v=jofNR\_WkoCE

# Flow Control in Bash: for loops

#### For loops (sequence of numbers):

```
#!/bin/bash

#Prints 'Hello world'
echo Hello world

File=${1:?No parameter provided}
for i in `seq 1 $File`; do
        echo "This is number: ${i}."
done
```

#### Run the script:

```
$ sh helloworld.sh 10
```

#### For loops (list of items):

```
#!/bin/bash

#Prints 'Hello world'
echo Hello world

File=${1:?No parameter provided}
for i in $File; do
    cat ${i}
done
```

#### Run the script:

```
$ sh helloworld.sh \
"test.txt h_file2.txt"
```

# Flow Control in Bash: while loops

#### Run while a condition is true:

```
#!/bin/bash

#Prints 'Hello world'
echo Hello world

File=${1:?No parameter provided}
cat $File | while read -r LINE;
do
    cat $LINE
done
```

#### Run the script:

```
$ ls *.txt > filelist
$ sh helloworld.sh filelist
```

Concept check: Rewrite the first for-loop example using a while loop instead.

## **More Information**

Difference between login and nonlogin shells: <a href="http://howtolamp.com/articles/difference-between-login-and-non-login-shell/">http://howtolamp.com/articles/difference-between-login-and-non-login-shell/</a>

Bash Programming Tutorial: <a href="https://tldp.org/HOWTO/Bash-Prog-Intro-HOWTO.html">https://tldp.org/HOWTO/Bash-Prog-Intro-HOWTO.html</a>

More on parameter expansion: <a href="http://wiki.bash-hackers.org/syntax/pe">http://wiki.bash-hackers.org/syntax/pe</a>