

Shell scripting

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Workflow scripts

- A script is a file with a `.sh` extension. It contains a list of shell commands executed by an interpreter
- Shebang (`#!`) defines the interpreter on the first line
 - `#!/bin/bash` - commands interpreted by bash
 - `#!/usr/bin/python` - interpreted by Python
- A script file should have x permissions: `chmod u+x hello_world.sh`
- Running a script: `./hello_world.sh`

Variables

- Set a variable: `count_of_files=3`
- Wrong set a variable: `count_of_files = 3` (spaces)
- Quotes are optional. The following commands are equivalent:

```
file="/home/mdozmorov/work/README.md"  
file=/home/mdozmorov/work/README.md
```

- Use a variable: `echo $file`

Capturing output of a command into a variable using backticks

- Wrap a command into backticks - the backwards apostrophes that appear on a US English keyboard at the upper left, under the ~ (tilde)
- Equivalent saying “get the output of the backticked command as a string variable”

```
echo `date`  
CURRENT_DIR=`pwd`  
file_name=`basename /bin/mkdir`
```

Arguments of a script as variables

- Example of an argument: `./hello_world.sh "Hello World!"`
- Within a script, special variables are reserved:

```
echo $0      - prints the script name
echo $1      - prints the first argument
echo $2      - prints the second argument
echo ${10}   - prints the tenth argument
echo $#      - prints the number of arguments
```

Internal variables

Set system's parameters. Can be defined in system's configuration files
.bashrc, .bash_profile

DISPLAY - tells X11 on which display to open windows
EDITOR - default text editor; usually emacs or vim
HOME - path to user's home directory; same as ~
PATH - path to executable programs
PWD - current directory, same as pwd
SHELL - path to the current shell
TERM - current terminal type
USER - account name of current user, same as whoami

Use echo to see their content

Aliases

To avoid retyping commands - use an alias. Can be defined in system's configuration files `.profile` (Linux), `.bash_profile`, `.bashrc` (Mac)

```
alias lah='ls -lah'  
alias ..='cd ..'
```

```
# get top process eating memory  
alias psmem='ps auxf | sort -nr -k 4'  
alias psmem10='ps auxf | sort -nr -k 4 | head -10'
```

```
# get top process eating cpu  
alias pscpu='ps auxf | sort -nr -k 3'  
alias pscpu10='ps auxf | sort -nr -k 3 | head -10'
```

```
# Find files eating space in the current directory  
alias spacehogs='du -cks * | sort -rn'
```

Conditional execution (if .. then .. else)

```
if [ ! -e $results_dir ]; then
    mkdir $results_dir;
fi
```

Some popular operators for checking a condition include:

<code>-e <file></code>	- TRUE if a specific file/directory exists
<code>-s <file></code>	- TRUE if non-empty file
<code>-z <string></code>	- TRUE if the given string is empty
<code><string1> = <string2></code>	- TRUE if the two strings are equal

- `help test` - see all operators

Loops (for .. do .. done)

```
for file in `ls *.txt`; do
    echo $file;
    gzip $file;
done
```

- while-do-done construct also available

The PATH environment variable

- Unix executable commands are located in special folders

```
$ which ls
/usr/bin/ls
$ which cat
/usr/bin/cat
$ which head
/usr/bin/head
```

- Executables may be kept in many different places on the Unix system.
- The PATH environmental variable is a colon-delimited list of directories where your shell will look to find executable commands

```
$ echo $PATH
/Users/mdozmorov/miniconda2/bin:/Users/mdozmorov/.rvm/gems/rub
```

Exercise:

Expanding the PATH

- Often you need to install software **as a user**, i.e., not as root or sudo user
- Create user-specific bin, lib folders, like:

```
$ mkdir ~/.local/bin
```

```
$ mkdir ~/.local/lib
```

- .local is a hidden folder in your home directory (use `ls -lah` to see it)
- Add these folders to the search path: `export PATH=$PATH:$HOME/.local/bin:$HOME/.local/lib` - now, Unix will look there for executables
- Put the `export ...` command in `bash_profile` to automatically execute it every time you use shell

Installing software as a user

- Read README - each software is different
- When installing using make, typically:

```
$ ./configure --prefix=$HOME/.local  
$ make  
$ make install
```

- When using Python setup.py, typically:

```
$ python setup.py install --user
```

- When installing Python packages using pip

```
$ pip install --user FOOBAR
```

<https://unix.stackexchange.com/questions/42567/how-to-install-program-locally-without-sudo-privileges>