Introduction and refresher

INTRODUCTION TO BASH SCRIPTING

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Introduction to the course

This course will cover:

- Moving from command-line to a Bash script
- Variables and data types in Bash scripting
- Control statements
- Functions and script automation

Why Bash scripting? (Bash)

Firstly, let's consider why Bash?

- Bash stands for '**B**ourne **A**gain **Sh**ell' (a pun)
- Developed in the 80's but a very popular shell today. Default in many Unix systems, Macs
- Unix is the internet! (Running ML Models, Data Pipelines)
  - AWS, Google, Microsoft all have CLI's to their products

Why Bash scripting? (scripting!)

So why Bash scripting?

- Ease of execution of shell commands (no need to copy-paste every time!)
- Powerful programming constructs

Expected knowledge

You are expected to have some basic knowledge for this course.

- Understand what the command-line (terminal, shell) is
- Have used basic commands such as `cat` , `grep` , `sed` etc.

If you are rusty, don't worry - we will revise this now!

Shell commands refresher

Some important shell commands:

- `(e)grep` filters input based on regex pattern matching
- `cat` concatenates file contents line-by-line
- `tail` \ `head` give only the last `-n` (a flag) lines
- `wc` does a word or line count (with flags `-w` `-l`)
- `sed` does pattern-matched string replacement

A reminder of REGEX

'Regex' or *regular expressions* are a vital skill for Bash scripting.

You will often need to filter files, data within files, match arguments and a variety of other uses. It is worth revisiting this.

To test your regex you can use helpful sites like `regex101.com`

Some shell practice

Let's revise some shell commands in an example.

Consider a text file `fruits.txt` with 3 lines of data:

```
banana
apple
carrot
```

If we ran `grep 'a' fruits.txt` we would return:

```
banana
apple
carrot
```

Some shell practice

But if we ran `grep 'p' fruits.txt` we would return:

```
apple
```

Recall that square parentheses are a matching set such as `[eyfv]`. Using `^` makes this an inverse set (**not** these letters/numbers)

So we could run `grep '[pc]' fruits.txt` we would return:

```
apple
carrot
```

Some shell practice

You have likely used 'pipes' before in terminal. If we had many many fruits in our file we could use `sort | uniq -c`

- The first will sort alphabetically, the second will do a count
- If we wanted the top *n* fruits we could then pipe to `wc -l` and use `head`

```
cat new_fruits.txt | sort | uniq -c | head -n 3
```

```
  14 apple
  13 bannana
  12 carrot
```

Let's practice!

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Your first Bash script

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Bash script anatomy

A Bash script has a few key defining features:

- It usually begins with `#!/usr/bash` (on its own line)
  - So your interpreter knows it is a Bash script and to use Bash located in `/usr/bash`
  - This could be a different path if you installed Bash somewhere else such as `/bin/bash` (type `which bash` to check)
- Middle lines contain code
  - This may be line-by-line commands or programming constructs

Bash script anatomy

To save and run:

- It has a file extension `.sh`
  - Technically not needed if first line has the she-bang and path to Bash (`#!/usr/bash`), but a convention
- Can be run in the terminal using `bash script_name.sh`
  - Or if you have mentioned first line (`#!/usr/bash`) you can simply run using `./script_name.sh`

Bash script example

An example of a full script (called `eg.sh`) is:

```
#!/usr/bash
echo "Hello world"
echo "Goodbye world"
```

Could be run with the command `./eg.sh` and would output:

```
Hello world
Goodbye world
```

Bash and shell commands

Each line of your Bash script can be a shell command.

Therefore, you can also include pipes in your Bash scripts.

Consider a text file (`animals.txt`)

```
magpie, bird
emu, bird
kangaroo, marsupial
wallaby, marsupial
shark, fish
```

We want to count animals in each group.

Bash and shell commands

In shell you could write a chained command in the terminal. Let's instead put that into a script (`group.sh`):

```
#!/usr/bash
cat animals.txt | cut -d " " -f 2 | sort | uniq -c
```

Now (after saving the script) running `bash group.sh` causes:

```
   2 bird
   1 fish
   2 marsupial
```

Let's practice!

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Standard streams & arguments

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STDIN-STDOUT-STDERR

In Bash scripting, there are three 'streams' for your program:

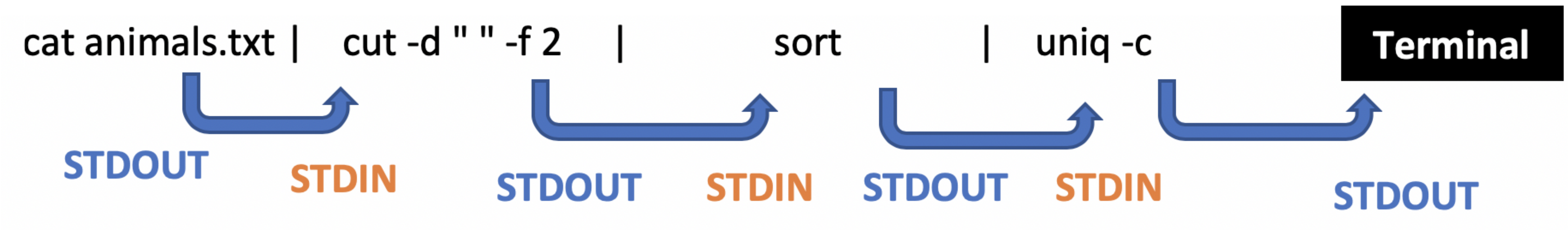
- STDIN (standard input). A stream of data into the program
- STDOUT (standard output). A stream of data **out** of the program
- STDERR (standard error). Errors in your program

By default, these streams will come from and write out to the terminal.

Though you may see `2> /dev/null` in script calls; redirecting STDERR to be deleted. (`1> /dev/null` would be STDOUT)

STDIN-STDOUT graphically

Here is a graphical representation of the standard streams, using the pipeline created previously:



STDIN example

Consider a text file (`sports.txt`) with 3 lines of data.

```
football
basketball
swimming
```

The `cat sports.txt 1> new_sports.txt` command is an example of taking data from the file and writing STDOUT to a new file. See what happens if you `cat new_sports.txt`

```
football
basketball
swimming
```

STDIN vs ARGV

A key concept in Bash scripting is **arguments**

Bash scripts can take **arguments** to be used inside by adding a space after the script execution call.

- ARGV is the array of all the arguments given to the program.
- Each argument can be accessed via the `$` notation. The first as `$1` , the second as `$2` etc.
- `$@` and `$*` give all the arguments in ARGV
- `$#` gives the length (number) of arguments

ARGV example

Consider an example script (`args.sh`):

```
#!/usr/bash
echo $1
echo $2
echo $@
echo "There are " $# "arguments"
```

Running the ARGV example

Now running

`bash args.sh one two three four five`

```
one
two
one two three four five
There are 5 arguments
```

```
#!/usr/bin/bash
echo $1
echo $2
echo $@
echo "There are " $# "arguments"
```

Let's practice!

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