Shell Command & Shell Script

2023-2024

COMP2113B/C Programming Technologies / ENGG1340B/C Computer Programming II

Dr. Chenxiong Qian & Dr. T.W. Chim (E-mail: cqian@cs.hku.hk & twchim@cs.hku.hk)

Department of Computer Science, The University of Hong Kong

We are going to learn…

- Useful Shell commands
- Shell Script
  - A "Hello World" example
  - Variables
  - No quote, 'single quote' and "double quote"
  - String operations
  - Flow of control (if-else, for loop)
  - Mathematical operations
  - Arguments

Useful Shell Commands

- *Please refer to Module 1 for details!*
- *You must try them in order to remember them!*

Directory manipulations

Command	Meaning
pwd	n fb **present working directory**...
ls **ls -l**	... fb n ; fb ; ; n fb ; ...
cd dir **cd** ~ **cd** .. **cd** .	**changes** dir... n ... ... ; n n w ffb ...
mkdir dir	**creates** n dir...
rmdir dir	**removes** dir... fbdir **empty**...
rm -rf dir	**removes the non empty directory** dir c fb ..
mv dir dir2	fbdir2 **does not exist**; **renames** fb n dir dir2... ; **moves** dir dir2...
cp –r dir1 dir2	**copy** dir1 dir2 c

File manipulations 1

Command	Meaning
pico a.cpp	n y fb **a.cpp…**) ” ” w ffb n n [**vi** **vim**)W N w [N …
g++ a.cpp -o a.o	w n n n **a.cpp** y c **a.o…** y c n w y …y …
./a.o	w n **a.o…**

File manipulations 2

Command	Meaning
cp file1 file2	**Copy** file1 file2…
mv file dir **mv** file1 file2 **mv** dir1 dir2	fbdir ; **moves** file dir… fb n n) ….;.c file1 file2 fb [; **renames** file1 file2… n fb … fbdir2 y ; **mv** n w dir1 dir2…
rm file **rm –rf** dir	**Remove** file… **Remove** w fb dir.
touch file	**Create an empty file** n file…
cat file	**Display the content** fbfile…

Others

Command	Meaning
wc file	**counts** n c fb ; ; file…
sort file	**sorts** fbfile c …
cut **-d,** **-f1** file	fb **columns of data**… w n fb c fb **–d**; n fb c fb **–f**) fb n c fb n […
grep '**abc**' file	**returns the lines** fb abc"… N n c fb y) fb **-E**[…
uniq file	**removes adjacent duplicate** fb n …
diff file1 file2	**different** file1 file2… w ; **diff** n n n c fb n …
spell file	**incorrect words** file…

Examples

- What is the full path of your default directory when you startup your shell?

```
/   n  /           /        n
```

present working directory
c   ffb   …

- What are the directories in the root directory?

```
      /


        fb
```

- How to go back to your home directory?

Examples

- **Copy the source code hello.cpp to hello2.cpp**

```
        …         …
```

- **Rename hello2.cpp to backup.cpp**

```
n w       …    c         …
```

- **Create a directory “backup” and move backup.cpp in it.**

```
n      c
n wc        …    c
```

Wildcards

- **The Linux shell has a mechanism to generate a list of file names matching a pattern**

Wildcard	Meaning
	N **string** ...
	N **character**...

```
 n w        ... c
     c

             ...
hello.cpp    hello.o
```

File permission & security

- You can use the list directory command ls -l to return the permission code of files / directories.

```
       fb
     fb
-rw-------…          n                        .   fb
```

File permission & security

Type									

File permission & security

Type	User permissions			Group permissions			Others permissions		
-	r	w	-	-	-	-	-	-	-

User permissions

- c **Read)**<span>**r**</span>[; **Write)w**[; **Execute)x**[n fb fb fb …
- C n ”**rw-**”; **R** **W** fb ; c **x** fb …

File permission & security

- n fb fb /

```
chmod ]who{operator]permissions{ fb n
```

who

value	meaning
u	) [
g	
o	
a	) ; [

operator

value	meaning
+	n
-	n w n
=	n

permissions

value	meaning
r	n
w	n
x	y n

-)+[y)x[n)u[.
-)+[ )r[ )w[n)a[.
- n w)-[ )r[ )w[fb n)g[ )o[

n y fb

n fb

n fb

Examples

- List the permission of the files with prefix "hello."

```
            …
                …          n                               .         …
               …          n                                  .         …
```

- Take away the execute permission (x) on hello.o from user (u), what will happen?

```
     n       y      …
  ./      …
c    . ./       … .      n
```

Shell Script

Please refer to Module 2 for details!

Motivation

fb
n n N …
y r fb
n n c

n n w
n ;

```
#!/bin/bash
g++ … -o …
./… … < …y > …y
sort …y | uniq > r …y
spell r …y > n …y
diff r …y n …y | grep -E
…
```

```
./… …
< loop
< polo
< pool
```

Answer: c w
n n fb …
shell script…

A Hello World Example

My first shell script

- **#!/bin/bash** n fb fb …
- fb **#!** n c … ; **bash** n) **bash shell**[…

```
#!/bin/bash
…
```

#!/bin/bash

- ffb n n **Bash shell** ffb … **which bash** n n **Bash shell**…

Comments and echo

```
#!/bin/bash
# This is a comment
echo "Hello world!"
```

…

Commenting

- y fb ; fb # **comment** …

echo "Hello world!"

- echo n n fb w fb w c …
- fb -n fb …

  echo -n "Hello World!"

Execute(x) permission to run

- c n y c c **granting**)+[**execute**)**x**[n **user**)**u**[…

No execute (x) permission!

- w y n y

```
#!/bin/bash
# This is a comment
echo "Hello world!"
```

…

```
 ./       …
C   . ./       …  .     n

   n        y        …

 ./       …
```

Shell script is very useful

- n n fb n c fb
  n n c …

Note: < and > are used to redirect input from a file and redirect output to a file.

```
//add.cpp
#include   iostream
using namespace std:
int main()}
  int a; b; c:
  cin     a     b     c:
  cout     a    b    c            :
(
```

…

3 4 5

…y

12

…y

```
#!/bin/bash
     n
g++ add.cpp     add.o


./.add.o    input.txt    output.txt


cat output.txt
```

y n …

VERY USEFUL ☺!

n ;

y c ;

J c ./hello.sh

n y y n …

./. y n …

An interpreted language

- **interpreted language**; c
  n ...
  - n **parsed and interpreted by the shell every time the program is executed**...
  - ; n c
    y c fb n c fb y n ...
- **modify the program more quickly** c n ...
  - w ; n **slower** c
    y n ...

Variables

string variable only

- w c . **string**...
- W c n **case sensitive**...
- fb n w c ***a*** w **cat** ...

```
a cat
```

No space! **No space!**

IMPORTANT!!!!!!
There must be NO SPACE before and after the = sign.

- $ **retrieve the value** fb w c ...

```
echo a
```

A space

Spacing is critical!

Space before and after =

- BEFORE AFTER will cause problem w c command...

```
#!/bin/bash
a
echo a
```

y n ...

```
./. y n ...
./. y n ... . . a: command not found
```

NO space before and after =

- [Setting value] NO $ sign setting w fb w c ...
- [Retrieve value] Use $ sign retrieving w fb w c ...

```
#!/bin/bash
a
echo a
```

y n c...

```
./. y n c...
```

Variables

- w c **without declaration**...
- C **creates the variable automatically when a variable is used**...

The read command

- **read** n n fb n w c fb n n ...
- w c ***name*** n ; ...

```
#!/bin/bash
echo                n
read name
```

y n ...

```
./. y n       ...
                n
Chim
```

Variables

- w c **without declaration**...
- C **creates the variable automatically when a variable is used**...

Use $ when retrieve value

- **[Retrieving value]**
  r **retrieving** w
  fb w c ...

```
#!/bin/bash
echo                          n
read name
echo "           name"
```

y n ...

```
./. y n        ...
                     n
  n
Hello Chim
```

Quoting

Specifying strings

- **Quoting** w n n n

  …

  - Unquoted
  - 'Single quote'
  - "Double quote"

Unquoted

- fb w **without any quoting;** c n fb w fb **single word…**

Error: Unquoted word with space

- ; ”**pie**” **command**; fb **command not found…**

```
#!/bin/bash
a
echo  a
b
echo  b
```

y n …

```
./. y n …

./. y n … .          . pie: command not found
```

Single quote

- w c fbsingle quote c w fb ...

```
#!/bin/bash
a
echo  a
```

y n ...

```
./. y n ...
```

Single quote

- w c fb**single quote** c w fb …
  - w ; **does not support variable substitution**…

\ ; **NOT** c c w fbw c ***a*** fb **single quote**…

```
#!/bin/bash
a
echo a
b \
echo b
```

y n …

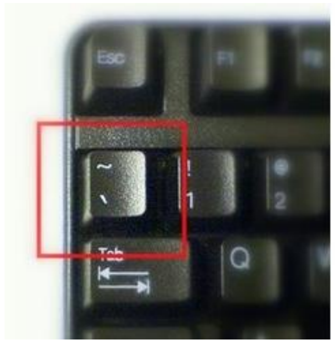
```
./. y n …

$a\$
```

Double quote

- ﬀb ﬁb n r ; **double quote will handle three special characters** ﬁb n ...

Symbol	Meaning
	Dollar sign - W c c ...
\	**Backslash -** ...
	Back quotes - c n n

c


C r

Where is the back quote button on keyboard?

Double quote

```
#!/bin/bash
a
b     a
echo   b
```

y n   …

```
 ./. y n      …
Apple pie
```

Supports value with space

- c r n w
  …

Supports variable substitution

- c r variable substitution;
  fb w fbw c ***b*** Apple pie
  c **NOT** $a …

Double quote

```
#!/bin/bash
a
b     a
echo  b
c   \        a
echo  c
d    ls
echo  d
```

y n ...

```
./. y n    ...

$a = Apple pie
example6.sh
```

Supports escape characters

- escape characters
  c r ...
- ….,;.\$
  \$a c c
  w fbw c *a*

`Back quote` = shell command!

- C r n shell command…
- fb ; `ls` c y
  command c the result of the
  command…
) ….,;.`ls` fb
  ; example6.sh
  y n [

Double quote

- **back quotes** ; fb **command** w c fb fb …

C

fb

```
#!/bin/bash
a fb
echo a
```

y n …

```
./ y n …
Apple Banana Cherry
```

Question:
c
each
word fb

Answer:
n ”**for** ”
n n ;
c .

String operations

String Operation

- fb n n c fb …
  -
  - c
  - fb

String length

- **String length.** w *a*; fb
  n c fb *a*...

$$\boxed{\${\#a}}$$

```
#!/bin/bash
a
echo            fb\ $a\      ${#a}
```

y n ...

```
./. y n       ...
              fb'         5
```

\" is an escape character

${#a} returns the string length (i.e., 5)

Substring

- **Substring (use ":").** w *a*; fb c fb*a* fb n ***pos*** ***len***…

${*a*:*pos*:*len*}

```
#!/bin/bash
a
echo $a c . ${a:5:5}
```

y n …

```
./. y n …
c . apple
```

P	i	n	e		a	p	p	l	e

Note: fb w y …

Replace

- **Replace)** ”/”[… w *a*; fb
  fb n c **first**
  occurrence fb*from* *to*…

$${a/from/to}

```
#!/bin/bash
a
from
to J
echo -n fb \ $from\ c \ $to\
echo c n ${a/$from/$to}
```

```
./. y n …
fb c J c n Apple juice
```

Note: fb **-n**;
echo w
y **echo**

y n …

n …

Flow of Control

If-else statement

- c y fb if n c …

```
if [ condition ]
then
    fb n   n
fi
```

```
if [ condition 1 ]
then
    echo
elif [ condition 2 ]
then
    echo
else
    echo
fi
```

[condition] for string

- fb n n …

String comparisons	Meaning
[*string*]	**True** fb fb *string*
[*string1* == *string2*]	**True** fb r
[*string1* != *string2*]	**True** fb fb
[*string1* \> *string2*]	**True** fb *string1* fb *string2*
[*string1* \< *string2*]	**True** fb *string1* c fb *string2*

string1 *string2* **double quote** n **work even if there are spaces inside** *string1* *string2*…

Spacing is critical!

```
if ["$ans"=="Y"]
```

- fb NO SPACE c n ; n n command... fb "Command not found"

```
./. y n ...
n w ... fb ) / [

./example11.sh: [Y==Y] command not found
```

```
#!/bin/bash
echo                    n  w   ...   fb   ) /  [
read ans
if [   ans        ]
then
    rm -rf *.cpp
    echo    ...  fb        n  w
fi
```

y n ...) [

```
if [ "$ans" == "Y" ]
```

space space space space space

[condition] for file

- w w fb

  ...

File checking	Meaning
[-e *file*]	True fb*file* exists...
[-f *file*]	True fb*file* is a file...
[-d *file*]	True fb*file* is a directory...
[-s *file*]	True fb*file* has size > 0...
[-r *file*]	True fb*file* is readable...
[-w *file*]	True fb*file* is writable...
[-x *file*]	True fb*file* is executable...

Note: fb n
y ...

[condition] for file

- fb hello.cpp
  y .

```
./ y n ...
hello.cpp not found!
```

n n
compile run
hello.cpp;
n) [fb ...

```
#!/bin/bash
if [ -e hello.cpp ]
then









else
    echo ... fb
fi
```

y n ...

[condition] for file

- fbhello.cpp fb

```
 ./.  y  n          ...
Hello World!
```

```
#!/bin/bash
if  [ -e hello.cpp ]
then
    rm *.o
    g++ hello.cpp -o hello.o
    if [ -e hello.o ]
    then
        ./hello.o



    fi
else
    echo         ...         fb
fi
```

y n ...

[condition] for file

- fbhello.cpp
  n .

```
./. y n ...
Compilation failed!
) n
c n [
```

```
#!/bin/bash
if  [ -e hello.cpp ]
then
    rm *.o
    g++ hello.cpp -o hello.o 2> error.txt
    if [ -e hello.o ]
    then
        ./hello.o
    else
        echo n fb
        cat error.txt
    fi
else
    echo ... fb
fi
```

y n ...

[condition] for command

- c shell **command**...
- w fb n n y fb ...

```
  ./. y n        ...
cp: cannot stat `file'123 : No such file or directory
Command failed
          fb
 ./. y n        ...
Command executed successfully
     fb

file123 fileabc
```

```
#!/bin/bash
if cp file123 fileabc
then
  echo    n n      y               fb
else
   echo    n n     fb
fi
```

y n ...

for loop

- for fb …

```
#!/bin/bash
list
for i in $list
do
  echo                    i
done
```

y n …

```
./. y n      …
            1
            2
            3
            4
            5
```

for loop

`ls *.cpp`

```
#!/bin/bash
list `ls *.cpp`
for name in  list
do
  cp  name     name.c
done
```

c   ...

- n n   ls *.cpp
  fb   .cpp
  fb   fby)fb   y   [...

```
        ...    c...
./.c        ...
      ...
...      a.cpp.backup
c...     b.cpp.backup
```

for   ;
c   .cpp fb
☺

Mathematics operations

Mathematics operations

- n n fb n n … w ; fb n n n let n n …

```
#!/bin/bash
a 10
let a a a a/ a
echo a
```

y n …

```
./. y n …
```

[condition] for numbers

- fb fb n n n n
  fb **if** n ; y
  …

Integer comparisons	Meaning
[*a* -eq *b*]	True fb*a* *b*
[*a* -ne *b*]	True ffb*a* *b*
[*a* -lt *b*]	True ffb*a* *b*
[*a* -le *b*]	True ffb*a* *b*
[*a* -gt *b*]	True ffb*a* *b*
[*a* -ge *b*]	True ffb*a* *b*

Mathematics operations

- n

  ffb ...

```
./. y n ...
C n ;

C n ;
```

```
#!/bin/bash
a 100
b 99
echo C n ;
if [ a \> b ]
then
 echo
else
 echo c
fi

echo C n ;
if [ a -gt b ]
then
 echo
else
 echo c
fi
```

y n ...

Arguments

Getting arguments

- **Command line arguments** c ***$0***; ***$1***; ….. ***$9***… ; ***$0*** n fb …
  - n n n fb ***$9*** c ***${10}***; ……
  - **$#** n c fb n y …

```
./. y n … n
3 n
./example18.sh
sun
mon
tue
```

```
#!/bin/bash
echo "There are $# arguments"
echo \ $0
echo \ $1
echo \ $2
echo \ $3
```

y n …

END

2023-2024
COMP2113B/C Programming Technologies / ENGG1340B/C Computer Programming II
Dr. Chenxiong Qian & Dr. T.W. Chim (E-mail: cqian@cs.hku.hk & twchim@cs.hku.hk)
Department of Computer Science, The University of Hong Kong