

Shell Programming

Put distinctive simple tools together to accomplish your goal...

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Why Shell Programming

❑ Just like coding in C/C++

- Variables
- If-else
- Loop
- Read from keyboard
- Output to screen
- **Execute other command**
 - In C/C++: `system()`

❑ Using shell syntax

Outline

- ❑ Variable pre-operations
- ❑ args, argc in Shell Scripts
- ❑ Arithmetic and Logics
 - Test commands
- ❑ Control Structures: if-else, switch-case, for/while loops
- ❑ Input/output: Read from screen
- ❑ Defining Functions & Parsing Arguments
- ❑ Error Handling and Debug tool (sh -x)
- ❑ A Shell Script Sample: Failure Detection on Servers

- ❑ Appendix: Regular Expression
- ❑ Appendix B: sed and awk

Bourne Shell

- ❑ We use Bourne Shell in this slide
- ❑ Check your login shell
 - % echo \$SHELL
 - => /bin/tcsh
- ❑ Change to Bourne Shell (sh)
 - % sh
 - \$

Sample script

- ❑ Print "Hello World" 3 times

```
#!/bin/sh
# ^ shebang: tell the system which interpreter to use

for i in `seq 1 3` ; do
    echo "Hello world $i" # the body of the script
done
```

test.sh

- ❑ Output

```
$ chmod +x test.sh
```

grant execution permission

```
$ ./test.sh
```

execute the script. Must specify the directory (./)

Executable script

❑ Shebang

- `#!/bin/sh`
- `#!/bin/bash`
- `#!/usr/local/bin/bash`
- `#!/usr/bin/env bash`
- `#!/usr/bin/env ruby`
- `#!/usr/bin/env python`

❑ Execution

- `$ sh test.sh` **Can execute without shebang**
- `$ chmod a+x test.sh`
- `$./test.sh`

Shell variables (1)

□ Assignment

	Syntax	Scope
Variable	<code>my=test</code>	Process
Local variable	<code>local my=test</code>	Function
Environment variable	<code>export my</code>	Process and sub-process



- Example:
 - `$ export PAGER=/usr/bin/less`
 - `$ current_month=`date +%m``
 - `$ myFun() { local arg1="$1" }`

Shell variables (2)

There are two ways to call variable...

"\${var}"... why?

❑ Access

- % echo "\$PAGER"
- % echo "\${PAGER}"
- Use {} to avoid ambiguity
 - % temp_name="haha"  No space beside '='
 - % temp="hehe"
 - % echo \$temp
 - hehe
 - % echo \$temp_name
 - haha
 - % echo \${temp}_name  More clear...
 - hehe_name
 - % echo \${temp_name}
 - haha

Quotation marks

- ❑ Single quotes('xxx')
 - Preserves the literal value of each character within the quotes
 - `$ echo 'echo $USER'`
`> echo $USER`
- ❑ Double quotes("xxx")
 - Parse special character, like: `$ ` \`
 - `$ echo "echo $USER"`
`> echo lcltseng`
- ❑ Back quotes(`xxx`)
 - The stdout of the command
 - `$ echo `echo $USER``
`> lcltseng`
 - `$ echo now is `date``
`> now is Sat Jun 15 03:56:54 CST 2019`

Shell variable operator (1)

※ Bad == not Good

"Bad" : var is not set or the value is null

"Good" : var is set and is not null

operator	Description
<code>\${var:=value}</code>	If "Bad", use the value and assign to var
<code>\${var:+value}</code>	If "Good", use the value instead else <u>null value is used</u> but not assign to var → Replace if "Good", not assign
<code>\${var:-value}</code>	If "Good", use the value of var else use the value but not assign to var → Replace if "Bad", not assign
<code>\${var:?value}</code>	If "Bad", print value and <u>shell exits</u>

"Parameter Expansion" in sh(1)

Print → stderr

The command stops immediately

Shell variable operator (2)

❑ Ex:

```
#!/bin/sh
```

```
var1="haha"
```

```
echo "01" ${var1:+"hehe"}
```

```
echo "02" ${var1}
```

```
echo "03" ${var2:+"hehe"}
```

```
echo "04" ${var2}
```

```
echo "05" ${var1:="hehehe"}
```

```
echo "06" ${var1}
```

```
echo "07" ${var2:="hehehe"}
```

```
echo "08" ${var2}
```

```
echo "09" ${var1:-"he"}
```

```
echo "10" ${var1}
```

```
echo "11" ${var3:-"he"}
```

```
echo "12" ${var3}
```

```
echo "13" ${var1:? "hoho"}
```

```
echo "14" ${var1}
```

```
echo "15" ${var3:? "hoho"}
```

```
echo "16" ${var3}
```

❑ Result:

```
01 hehe
```

```
02 haha
```

```
03
```

```
04
```

```
05 haha
```

```
06 haha
```

```
07 hehehe
```

```
08 hehehe
```

```
09 haha
```

```
10 haha
```

```
11 he
```

```
12
```

```
13 haha
```

```
14 haha
```

```
hoho
```

```
16
```

Shell variable operator (3)

operator	description
<code>\${#var}</code>	String <u>length</u>
<code>\${var#pattern}</code>	Remove the <u>smallest prefix</u>
<code>\${var##pattern}</code>	Remove the <u>largest prefix</u>
<code>\${var%pattern}</code>	Remove the <u>smallest suffix</u>
<code>\${var%%pattern}</code>	Remove the <u>largest suffix</u>

```
#!/bin/sh
```

These operators do not change the value of var...

```
var="Nothing happened end closing end"
```

```
echo ${#var}
echo ${var#*ing}
echo ${var##*ing}
echo ${var%end*}
echo ${var%%end*}
```

Results:

```
32
happened end closing end
end
Nothing happened end closing
Nothing happened
```

Predefined shell variables

Similar to C program's "Int main(argc, args)" – **arguments of program**,
e.g. `ls -a ~`

- Environment Variables
- Other useful variables:

sh	description
\$#	<u>Number</u> of positional arguments (start from 0)
\$0	Command name (Ex: What command user exec your script)
\$1, \$2, ..	Positional <u>arguments</u>
\$* / @\$	List of <u>positional arguments</u> (useful in for loop) \${*:2} : Get the list of argument after \$2
\$?	<u>Return code</u> from last command
\$\$	<u>Process number</u> of current command (pid)
#!	<u>Process number</u> of last background command

Usage of \$* and @\$

- ❑ The difference between \$* and @\$
 - \$* : all arguments are formed into a long string
 - @\$: all arguments are formed into separated strings
- ❑ Examples: test.sh

```
for i in "$*" ; do
  echo "In loop: $i"
done
```

```
% test.sh 1 2 3
In loop: 1 2 3
```

```
for i in "$@" ; do
  echo "In loop: $i"
done
```

```
% test.sh 1 2 3
In loop: 1
In loop: 2
In loop: 3
```

test command

Checking things for us... e.g. file status, statements

❑ test(1)

- test expression
- [expression]
- Test for: file, string, number

❑ Test and **return 0 (true) or 1 (false)** in \$?

- % test -e News ; echo \$? **→ \$? To obtain the return code**
 - If there exist the file named "News"
- % test "haha" = "hehe" ; echo \$?
 - Whether "haha" **equal** "hehe"
- % test 10 -eq 11 ; echo \$?
 - Whether 10 **equal** 11

Details on the capability of test command – File test

- ❑ **-e file**
 - True if file **e**xists (regardless of type)
- ❑ **-s file**
 - True if file exists and has a **s**ize greater than zero
- ❑ **-b file**
 - True if file exists and is a **b**lock special file
- ❑ **-c file**
 - True if file exists and is a **c**haracter special file
- ❑ **-d file**
 - True if file exists and is a **d**irectory
- ❑ **-f file**
 - True if file exists and is a regular **f**ile
- ❑ **-p file**
 - True if file is a named **p**ipe (FIFO)
- ❑ **-L file**
 - True if file exists and is a symbolic **l**ink
- ❑ **-S file**
 - True if file exists and is a **s**ocket
- ❑ **-r file**
 - True if file exists and is **r**eadable
- ❑ **-w file**
 - True if file exists and is **w**ritable
- ❑ **-x file**
 - True if file exists and is **e**xecutable
- ❑ **-u file**
 - True if file exists and its set **u**ser ID flag is set
- ❑ **-g file**
 - True if file exists and its set **g**roup ID flag is set
- ❑ **-k file**
 - True if file exists and its **s**ticky bit is set
- ❑ **-O file**
 - True if file exists and its owner matches the effective user id of this process
- ❑ **-G file**
 - True if file exists and its group matches the effective group id of this process
- ❑ **file1 -nt file2**
 - True if file1 exists and is **n**ewer than file2
- ❑ **file1 -ot file2**
 - True if file1 exists and is **o**lder than file2
- ❑ **file1 -ef file2**
 - True if file1 and file2 **e**xist and refer to the same file

Hard links to same file..

Details on the capability of test command – String test

- ❑ **-z string**
 - True if the length of string is **z**ero
- ❑ **-n string**
 - True if the length of string is **n**onzero
- ❑ **string**
 - True if string is not the null string
- ❑ **s1 = s2** (though some implementation recognize ==)
 - True if the strings s1 and s2 are identical
- ❑ **s1 != s2**
 - True if the strings s1 and s2 are not identical
- ❑ **s1 < s2**
 - True if string s1 comes before s2 based on the binary value of their characters
- ❑ **s1 > s2**
 - True if string s1 comes after s2 based on the binary value of their characters

Details on the capability of test command – Number test

- ❑ `n1 -eq n2` `==, !=, >, <, >=, <=` fashion does not apply here...
 - True if the integers `n1` and `n2` are algebraically equal
- ❑ `n1 -ne n2`
 - True if the integers `n1` and `n2` are not algebraically equal
- ❑ `n1 -gt n2`
 - True if the integer `n1` is algebraically greater than the integer `n2`
- ❑ `n1 -ge n2`
 - True if the integer `n1` is algebraically greater than or equal to the integer `n2`
- ❑ `n1 -lt n2`
 - True if the integer `n1` is algebraically less than the integer `n2`
- ❑ `n1 -le n2`
 - True if the integer `n1` is algebraically less than or equal to the integer `n2`

test command – combination

❑ ! expression

- True if expression is false.
- `$ [! A == B] =>` Test expression, invert the internal result
- `$! [A == B] =>` Invert the whole test command result

❑ expression1 -a expression2

- True if both expression1 and expression2 are true.
- `$ [A == B -a C == D]`
- `$ [A == B] && [C == D]`

❑ expression1 -o expression2

- True if either expression1 or expression2 are true.
- **The -a operator has higher precedence than the -o operator.**
- `$ [A == B -o C == D]`
- `$ [A == B] || [C == D]`

test command – combination example

❑ `! ["A" = "A" -o 1 -eq 1]`

- false

❑ `[! "A" = "A" -o 1 -eq 1]`

- true

test command – in script

- ❑ Add space beside = <= != []...
 - \$ [A=B] # error
 - \$ [A=B] # error
 - \$ [A = B] # error
- ❑ If the var may be null or may not be set, add ""
 - \$ [\$var = "A"] may be parsed to [= "A"] and cause **syntax error!!**
 - \$ ["\$var" = "A"] become ["" = "A"]

```
if [ "$var" = "hehe" ] ; then
    echo '$var equals hehe'
else
    echo '$var doesn't equal hehe'
fi
```

expr command (1)

AND - OR – NOT (&&, ||, !)

```
$ [ 1 -eq 2 ] || [ 1 -eq 1 ] ; echo $?
0
```

```
$ [ 1 -eq 2 ] && [1 -eq 1]; echo $?
1
```

```
$ [ 1 -eq 1 ] || [1 -eq 2]; echo $?
0
```

```
$ ! [ 1 -eq 2 ] ; echo $?
0
```

```
$ [ 1 -eq 1 ] && [ 1 -eq 2 ] ; echo $?
1
```

```
$ [ 1 -eq 2 ] ; echo $?
1
```

expr command (2)

- ❑ `$ expr1 && expr2` , if `expr1` is false then `expr2` won't be evaluate
- ❑ `$ expr1 || expr2` , if `expr1` is true then `expr2` won't be evaluate
- ❑ Ex:
 - `$ [-e SomeFile] && rm SomeFile`
 - `$ checkSomething || exit 1`

Arithmetic Expansion

```
echo $(( 1 + 2 ))           3

a=8                          // a=8
a=$(( $a + 9 ))             // a=17
a=$(( $a + 17 ))            // a=34
a=$(( $a + 9453 ))          // a=9487
echo $a                      9487
```


if-then-else structure



```
if [ test conditions ] ; then
```

```
    command-list
```

```
elif [ test conditions ] ; then
```

```
    command-list
```

```
else
```

```
    command-list
```

```
fi
```

```
# Or in one line
```

```
if [ a = a ] ; then echo "Yes"; else echo "No"; fi
```

switch-case structure (1)

```
case $var in
  value1)
    action1
  ;;
  value2)
    action2
  ;;
  value3|value4)
    action3
  ;;
  *)
    default-action
  ;;
esac
```

```
case $sshd_enable in
  [Yy][Ee][Ss])
    action1
  ;;
  [Nn][Oo])
    action2
  ;;
  *)
    ???
  ;;
esac
```

For loop

```
for var in var1 var2 ...; do  
    action  
done
```

```
for i in A B C D E F G; do  
    mkdir $i;  
done
```

```
a=""  
for var in `ls`; do  
    a="$a $var"  
done  
echo $a
```

While loop



```
while [...] ; do
```

```
    action
```

```
done
```

```
break
```

```
continue
```

```
while read name ; do
```

```
    echo "Hi $name"
```

```
done
```

Read from `stdin`

```
#!/bin/sh
echo -n "Do you want to 'rm -rf /' (yes/no)? "
read answer # read from stdin and assign to variable
case $answer in
    [Yy][Ee][Ss])
        echo "Hahaha"
        ;;
    [Nn][Oo])
        echo "No~~~"
        ;;
    *)
        echo "removing..."
        ;;
esac
```

Create tmp file/dir

- ❑ `TMPDIR=`mktemp -d tmp.XXXXXXX``
- ❑ `TMPFILE=`mktemp ${TMPDIR}/tmp.XXXXXXX``
- ❑ `echo "program output" >> ${TMPFILE}`

functions (1)

- ❑ Define function

```
function_name () {  
    command_list  
}
```

- ❑ Removing function definition

```
unset function_name
```

- ❑ Function execution

```
function_name
```

- ❑ Function definition is local to the current shell

※ Define the function before first use...

functions (2) - scoping

```
func () {  
    # global variable  
    echo $a  
    a="hello"  
}  
a="5566"
```

```
func  
echo $a
```

Result:
5566
hello

```
func () {  
    # local variable  
    local a="hello"  
    echo $a  
}  
a="5566"
```

```
func  
echo $a
```

Result:
hello
5566

functions (3) - arguments check

```
func () {  
    if [ $# -eq 2 ] ; then  
        echo $1 $2  
    else  
        echo "Wrong"  
    fi  
}  
func  
func hi  
func hello world
```

Result:

Wrong

Wrong

hello world

functions (4) - return value

```
func () {  
    if [ $# -eq 2 ] ; then  
        return 0  
    else  
        return 2  
    fi  
}  
func  
echo $?  
func hello world  
echo $?
```

Result:

2
0

Scope

- ❑ Local var can only be read and written inside the function.
- ❑ Subprocess can **only read** the environment variable, the modification of the variable will **NOT** be effective to the current process. (Subprocess may include some PIPE execution)
- ❑ If something wrong, try to print every variable.
- ❑ Ex:

```
#!/bin/sh
a=10
export b=20
cat test.sh | while read line; do
    echo "$a $b $line"
    b=$((b+1))
done
echo b is $b # b is 20
```

test.sh

```
10 20 #!/bin/sh
10 21 a=10
10 22 export b=20
10 23 cat test.sh | while read line; do
10 24 echo "$a $b $line"
10 25 b=$((b+1))
10 26 done
10 27 echo b is $b
b is 20
```

Parsing arguments

❑ Use getopt (recommended)

```
#!/bin/sh

while getopts abcf: op ; do
    echo "${OPTARG}-th arg"

    case $op in
        a|b|c)
            echo "one of ABC" ;;
        f)
            echo $OPTARG ;;
        *)
            echo "Default" ;;
    esac
done
```

```
$ ./test.sh -a -b -c -f gg
2-th arg
one of ABC
3-th arg
one of ABC
4-th arg
one of ABC
6-th arg
gg
```

":" means additional arg.
\$OPTARG: content of arguments
\$OPTARG: index of arguments

Handling Error Conditions

- ❑ Internal error ← program crash
- Caused by some command's failing to perform
 - User-error
 - Invalid input
 - Unmatched shell-script usage
 - Command failure

- ❑ External error ← signal from OS
- By the system telling you that some system-level event has occurred by sending signal
 - Ctrl+C
 - SIGINT

Handling Error Conditions – Internal Error

❑ Ex:

```
#!/bin/sh
UsageString="Usage: $0 -man=val1 -woman=val2"

if [ $# != 2 ] ; then
    echo "$UsageString"
else
    echo "ok!"
    man=`echo $1 | cut -c 6-`
    woman=`echo $2 | cut -c 8-`
    echo "Man is ${man}"
    echo "Woman is ${woman}"
fi
```

program name

How about c but not -c?

start from 6th character

→ Handling the errors yourself...

Handling Error Conditions – External Error (1)

❑ Using trap in Bourne shell

- `trap [command-list] [signal-list]`
 - Perform command-list when receiving any signal in signal-list

Usag: `trap "[commands]" list of signals looking for...`

```
trap "rm tmp*; exit0" 1 2 3 14 15
```

```
trap "" 1 2 3
```

 Ignore signal 1 2 3

Handling Error Conditions – External Error (2)

#	Name	Description	Default	Catch	Block	Dump core
1	SIGHUP	Hangup	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	SIGINT	Interrupt (^C)	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	SIGQUIT	Quit	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9	SIGKILL	Kill	Terminate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	SIGBUS	Bus error	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
11	SIGSEGV	Segmentation fault	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
15	SIGTERM	Soft. termination	Terminate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
17	SIGSTOP	Stop	Stop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	SIGTSTP	Stop from tty (^Z)	Stop	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
19	SIGCONT	Continue after stop	Ignore	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Debugging Shell Script

Debug tools in sh...

❑ Ex:

```
#!/bin/sh -x
var1="haha"
echo "01" ${var1:+ "hehe"}
echo "02" ${var1}
echo "03" ${var2:+ "hehe"}
echo "04" ${var2}
echo "05" ${var1:= "hehehe"}
echo "06" ${var1}
echo "07" ${var2:= "hehehe"}
echo "08" ${var2}
echo "09" ${var1:- "he"}
echo "10" ${var1}
echo "11" ${var3:- "he"}
echo "12" ${var3}
echo "13" ${var1:? "hoho"}
echo "14" ${var1}
echo "15" ${var3:? "hoho"}
echo "16" ${var3}
```

Debug mode

❑ Result:

```
+ var1=haha
+ echo 01 hehe
01 hehe
+ echo 02 haha
02 haha
+ echo 03
03
+ echo 04
04
+ echo 05 haha
05 haha
+ echo 06 haha
06 haha
+ echo 07 hehehe
07 hehehe
+ echo 08 hehehe
08 hehehe
+ echo 09 haha
09 haha
+ echo 10 haha
10 haha
+ echo 11 he
11 he
+ echo 12
12
+ echo 13 haha
13 haha
+ echo 14 haha
14 haha
hoho
```

Debug msgs.
print out the
substitution results...

Useful tools

- head
- tail
- grep
- find
- ps
- xargs



Shell Script Examples

check alive (1)

❑ ping

- `/sbin/ping -c 3 bsd1.cs.nctu.edu.tw`

PING bsd3.cs.nctu.edu.tw (140.113.235.133): 56 data bytes

64 bytes from 140.113.235.133: icmp_seq=0 ttl=63 time=14.453 ms

64 bytes from 140.113.235.133: icmp_seq=1 ttl=63 time=15.144 ms

64 bytes from 140.113.235.133: icmp_seq=2 ttl=63 time=11.023 ms

--- bsd3.cs.nctu.edu.tw ping statistics ---

3 packets transmitted, 3 packets received, 0.0% packet loss

round-trip min/avg/max/stddev = 11.023/13.540/15.144/1.802 ms

check alive (2)

```
#!/bin/sh
# [Usage] isAlive.sh bsd1.cs.nctu.edu.tw
```

```
Usage="[Usage] $0 host"
temp="$1.ping"
Admin="lctseng"
count="3"
```

```
if [ $# != 1 ] ; then
  echo $Usage
else
```

```
  /sbin/ping -c ${count:=10} $1 | /usr/bin/grep 'transmitted' > $temp
  Lost=`awk -F" " '{print $7}' $temp | awk -F"." '{print $1}'`
```

```
  if [ ${Lost:=0} -ge 50 ] ; then
    mail -s "$1 failed" $Admin < $temp
  fi
  /bin/rm $temp
fi
```

default 10 times

Grep "tran..."

wrtie to the temp file

Mail and del. \$temp

- awk on \$temp using space as delimiter
- How many % packet loss?

Appendix A: Regular Expression

pattern matching

Regular Expression (1)

□ Informal definition

- Basis:
 - A single character "a" is a R.E.
- Hypothesis
 - If r and s are R.E.
- Inductive
 - Union: $r + s$ is R.E.
 - Ex: $a + b$
 - Concatenation: rs is R.E.
 - Ex: ab
 - Kleene closure: r^* is R.E.
 - Ex: a^*

Regular Expression (2)

❑ Pattern-matching

- Special operators

operator	Description
.	Any single character
[]	Any character in []
[^]	Any character not in []
^	<u>start</u> of a line
\$	end of a line
*	zero or more
?	zero or one
+	one or more
{m,n}	At least m times and at most n times
{m,}	At least m times.
{m}	Exactly m times.
\	Escape character

Regular Expression (3)

□ Examples

- `r.n`
 - Any 3-character string that start with r and end with n
 - `rln`, `rxn`, `r&n` will match
 - `r1xn`, `axn` will not match
- `..Z..`
 - Any 5-character strings that have Z as 3rd character
 - `aeZoo`, `12Zos` will match
 - `aeooZ`, `aeZoom` will not match
- `r[a-z]n`
 - Any 3-character string that start with r and end with n and the 2nd character is an alphabet
 - `rxn` will match
 - `rln`, `r&n` will not match

Regular Expression (4)

□ Examples

- `^John`
 - Any string starts with John
 - John Snow -> will match
 - Hi John -> will not match
- `[Ee][Nn][Dd]$`
 - Any string ends with any combination of "end"
- `[A-Za-z0-9]+`
 - String of characters

Regular Expression (5)

❑ Utilities using RE

- grep
- awk
- sed
- find

❑ Different tools, different RE

- BRE (Basic)
- ERE (Extended)
- PCRE (Perl Compatible)
- https://en.wikipedia.org/wiki/Regular_expression#Standards

Appendix B: sed and awk

Details on using sed and awk...

sed – Stream EDitor (1)

❑ sed(1)

- sed -e "command" -e "command"... file
- sed -f script-file file
 - Sed will (1) read the file line by line and (2) do the commands, then (3) output to stdout
 - e.g. sed -e '1,10d' -e 's/yellow/black/g' yel.dat

❑ Command format

- [address1[,address2]]function[argument]
 - From address 1 to address 2
 - Do what action

❑ Address format

- n → line number
- /R.E./ → the line that matches R.E

sed – Stream EDitor (2)

- Example of address format
 - sed -e 10d
 - sed -e /man/d
 - sed -e 10,100d
 - sed -e 10,/man/d
 - Delete line from line 10 to the line contain "man"

sed – Stream EDitor

Function: **print** (1)

❑ print

- Syntax:

[addr1, addr2]p

❑ Ex:

- `sed -n -e '/^lctseng/p'` Print out the lines that begins with lctseng

-n: By default, each line of input is echoed to the standard output after all of the commands have been applied to it. The **-n** option suppresses this behavior.

sed – Stream EDitor

Function: **print** (2)

- ❑ `sed -e '/^lctseng/p' input.txt`

```
hello  
lctseng  
lctseng  
world
```

```
hello  
lctseng  
world
```

```
input.txt
```

- ❑ `sed -n -e '/^lctseng/p' input.txt`

```
lctseng
```


sed – Stream EDitor

Function: **substitution** (1)

❑ substitution

- Syntax
 - s/pattern/replace/flags
- Flags
 - **N**: Make the substitution only for the N'th occurrence
 - **g**: replace all matches
 - **p**: print the matched and replaced line
 - **w**: write the matched and replaced line to a file

sed – Stream EDitor

Function: **substitution** (2)

❑ Ex:

- `sed -e 's/lctseng/LCTSENG/2' file`
- `sed -e 's/lctseng/LCTSENG/g' file`
- `sed -e 's/lctseng/LCTSENG/p' file`
- `sed -n -e 's/lctseng/LCTSENG/p' file`
- `sed -e 's/lctseng/LCTSENG/w wfile' file`

file

I am jon

I am john

I am lctseng

I am lctseng

I am nothing

sed – Stream EDitor

Function: **delete**

❑ delete

- Syntax:
[address]d

❑ Ex:

- sed -e 10d
- sed -e /man/d
- sed -e 10,100d
- sed -e 10,/man/d

sed – Stream EDitor

Function: **append, insert, change**

□ append, insert, change

- Syntax:

```
[address]a\  
text
```

```
[address]i\  
text
```

```
[address]c\  
text
```

- insert → insert before the line
- change → replace whole line

□ Ex:

- sed -f sed.src file

```
sed.src
```

```
/lctseng/i \  
Meet lctseng, Hello
```

```
file
```

```
I am jon  
I am john  
I am lctseng  
I am lctseng  
I am nothing
```

```
Results:
```

```
I am jon  
I am john  
Meet lctseng, Hello  
I am lctseng  
Meet lctseng, Hello  
I am lctseng  
I am nothing
```

awk

□ awk(1)

- `awk [-F fs] ['awk_program' | -f program_file] [data_file]`
 - awk will read the file line by line and evaluate the pattern, then do the action if the test is true
 - Ex:
 - `awk '{print "Hello World"}' file`
 - `awk '{print $1}' file`

□ Program structure

- `pattern { action }`
- missing pattern means always matches
- missing `{ action }` means print the line

Amy	32	0800995995	nctu.csie
\$1	\$2	\$3	\$4

awk – Pattern formats

□ pattern formats

- Regular expression
 - `awk '/[0-9]+/ {print "This is an integer" }`
 - `awk '/[A-Za-z]+/ {print "This is a string" }`
 - `awk '/^$/ {print "this is a blank line."}'`
- BEGIN
 - before reading any data
 - `awk ' BEGIN {print "Nice to meet you"}'`
- END
 - after the last line is read
 - `awk ' END {print "Bye Bye"}'`

awk – action format

□ Actions

- Print
- Assignment
- `if(expression) statement [; else statement2]`
 - `awk ' { if($2 ~ /am/) print $1 }' file`
- `while(expression) statement`
 - `awk 'BEGIN {count=0} /lctseng/ {while (count < 3) {print count;count++}}' file`
var usage: no need for "\$"
 - `awk 'BEGIN {count=0} /lctseng/ {while (count < 3) {print count;count++;count=0}}' file`
reset count after printing
- `for (init ; test ; incr) action`
 - `awk '{for (i=0;i<3;i++) print i}' file`

awk – built-in variables (1)

- ❑ \$0, \$1, \$2, ...
 - Column variables
- ❑ NF
 - Number of fields in current line
- ❑ NR
 - Number of line processed
- ❑ FILENAME
 - the name of the file being processed
- ❑ FS
 - Field separator, set by **-F**
- ❑ OFS
 - Output field separator

awk – built-in variables (2)

□ Ex:

- `awk 'BEGIN {FS=":"} /lctseng/ {print $3}' /etc/passwd`
 - 1002
- `awk 'BEGIN {FS=":"} /^lctseng/{print $3 $6}' /etc/passwd`
 - 1002/home/lctseng
- `awk 'BEGIN {FS=":"} /^lctseng/{print $3 " " $6}' /etc/passwd`
 - 1002 /home/lctseng
- `awk 'BEGIN {FS=":" ;OFS=="=="} /^lctseng/{print $3 , $6}' /etc/passwd`
 - 1002==/home/lctseng

```
lctseng:*:1002:20:Liang-Chi Tseng:/home/lctseng:/bin/tcsh
```

Reference

- ❑ awk(1)
- ❑ sed(1)
- ❑ <http://www.grymoire.com/Unix/Awk.html>
- ❑ <http://www.grymoire.com/Unix/Sed.html>
- ❑ https://en.wikipedia.org/wiki/Regular_expression