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- The bash shell allows you to create a library file for your functions, then reference that single library file in as many scripts as you need to.

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First Step-Creating The Library

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Using The Library

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- The Library can be using the source command has a shortcut alias, called the dot operator.

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```
$ cat test14
#!/bin/bash
# using functions defined in a library file
. ./myfuncs
value1=10
value2=5
result1=`addem $value1 $value2`
result2=`multem $value1 $value2`
result3=`divem $value1 $value2`
echo "The result of adding them is: $result1"
echo "The result of multiplying them is: $result2"
echo "The result of dividing them is: $result3"
$ ./test14
The result of adding them is: 15
```

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Using Functions on the Command Line

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- Sometimes it can be useful to create functions on the fly from the command prompt.

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- The first method defines the function all on one line:
 - \$ function divem { echo \${ \$1 / \$2 }; }
 - \$ divem 100 5

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Another Example

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Enter value: 20

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40

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```
$ function multem {  
    > echo ${$1 * $2}  
}>}  
$ multem 2 5
```

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A Second Technique

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```
$ function multem {  
    > echo ${$1 * $2}  
}>}  
$ multem 2 5
```

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Defining functions in the .bashrc file

- **Directly defining functions**
- You can define the functions directly in the .bashrc file in your home directory.
- Just add your functions to the bottom of the existing file. Here's an example of doing that:

```
$ cat .bashrc
# .bashrc
# Source global definitions
if [ -r /etc/bashrc ]; then
    . /etc/bashrc
fi
function addem {
    echo $[ $1 + $2 ]
}
$
```

Sourcing function files

```
# .bashrc
# Source global definitions
if [ -r /etc/bashrc ]; then
    . /etc/bashrc
fi
. /home/ankur/libraries/myfuncs
$
```

- The next time you start a shell, all of the functions in your library are available at the command line interface:

```
$ addem 10 5
15
$ multem 10 5
50
$ divem 10 5
2
$
```

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Try it out

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{The results will look something like the following, depending on the entries in the /etc/passwd file}

```
v  root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:/sbin/nologin
sync:x:5:0:sync:/sbin:/bin/sync
shutdown:x:6:0:shutdown:/sbin:/sbin/shutdown
halt:x:7:0:halt:/sbin:/sbin/halt
mail:x:8:12:mail:/var/spool/mail:/sbin/nologin
nobody:x:99:99:Nobody:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/sshd:/sbin/nologin
apache:x:48:48:Apache:/var/www:/sbin/nologin
webalizer:x:67:67:Webalizer:/var/www/usage:/sbin/nologin
```

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m

5

R

m

Extracting with AWK

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- The real working power of AWK is in extracting parts of data from a larger formatted body.

Using the /etc/passwd file again, the following command takes two of the fields from each entry in the /etc/passwd file and creates a more human-friendly output:

- awk -F ":" '{ print "username: " \$1 "\t\t\t user id:" \$3 }'

/etc/passwd

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How to Run awk Programs

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- If the program is short, it is easiest to include it in the command that runs awk, like this:

– awk 'program' input-file1 input-file2 ...

- When the program is long, it is usually more convenient to put it in a file and run it with a command like this:

– awk -f program-file input-file1 input-file2 ...

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Running awk Without Input Files

- You can also run awk without any input files. If you type the following command line:

\$ awk 'program'

- For Example:
- \$ awk "BEGIN { print \"Don't Panic!\" }"
- Don't Panic!

\$ awk "BEGIN { print \"Don't Panic!\" }"

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Emulating cat

\$ awk '{ print }'

- Now is the time for all good men

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- Now is the time for all good men
- to come to the aid of their country.
- to come to the aid of their country.

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Running Long Programs

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- In order to tell awk to use that file for its program, you type:
 - awk -f source-file input-file1 input-file2 ...
- For example, you could put the program:
 - BEGIN { print "Don't Panic!" }

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- Then this command:

– awk -f advice

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Executable awk Programs

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- You can also convert your scripts into executables:

SIIC – #!/bin/awk -f

– BEGIN { print "Don't Panic!" }

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An Example using the Data Files

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- An Example with two rules:

– \$ awk '/12/ { print \$0 }'

– \$ awk '/21/ { print \$0 }'

This program prints every line that contains the string 12 or the string 21.

- If a line contains both strings, it is printed twice, once by each rule.

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A More Complex Example

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- Look at this command:

– ls -l | awk '\$6 == "Nov" { sum += \$5 }'

– END { print sum }

This command prints the total number of bytes in all the files in the current directory that were last modified in November.

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REGULAR EXPRESSIONS

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- A regular expression, or regexp, is a way of describing a set of strings.

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- A regular expression enclosed in slashes (/) is an awk pattern that matches every input record whose text belongs to that set.

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How to Use Regular Expressions

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- For example, the following prints the second

field of each record that contains the string
foo any-where in it:

— \$ awk '/foo/ { print \$2 }' BBS-list

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Two Operators

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- The two operators **~** and **!~** perform regular

expression comparisons.

- For example:

— exp **~ /regexp/**

• is true if the expression exp (taken as a string)

matches regexp.

— This next example is true if the expression exp

(taken as a character string) does not match

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— exp **!~ /regexp/**

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- `$ awk '$1 ~ /J/' inventory-shipped`

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- `$ awk '$1 != /J/' inventory-shipped`

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- Some characters cannot be included literally in string constants ("foo") or regexp constants (/foo/).

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- Instead, they should be represented with escape sequences.

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- For example:
 - `$ awk 'BEGIN { print "He said \"hi!\" to her." }'`
 - He said "hi!" to her.

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List of Escape Sequences

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Escape Sequence		Meaning
\\\		A literal backslash
\a		Alert sequence
\b		Backspace
\n		Newline
\t		Horizontal Tab
\v		Vertical Tab
\nnn		Octal Value
\/		A literal Slash
\"		Double quotes

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- You can combine regular expressions with special characters, called regular expression operators or metacharacters, to increase the power and versatility of regular expressions.

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- **** This is used to suppress the special meaning of a character when matching. For example, \\$ matches the character \$.

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- **^** This matches the beginning of a string. For example, ^@chapter matches @chapter at the beginning of a string.

- **\$** This is similar to ^, but it matches only at the end of a string. For example, p\$ matches a record that ends with a p.

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- **.** (A period, or “dot.”) This matches any single character, including the newline character. For example, .P matches any single character followed by a P.

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- **[...]** This is called a character list. * It matches any one of the characters that are enclosed in the square brackets.
- **[^...]** This is a complemented character list. The first character after the [must be a ^. It matches any characters except those in the square brackets.
- **|** This is the alter nation operator and it is used to specify alternatives.
- ***** This symbol means that the preceding regular expression should be repeated as many times as necessary to find a match.
- **+** This symbol is similar to *, except that the preceding expression must be matched at least once.

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- **?1** This symbol is similar to *, except that the preceding expression can be matched either once or not at all.

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- **{n}, {n,}, {n,m}** One or two numbers inside braces denote an interval expression.

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Matches whhy, but not why or whhhh.

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Matches whhhhy, whhhhhy, or whhhhhhy, only.

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wh{2,}y

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Matches whhy or whhhhy, and so on

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Using Character Lists

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- Within a character list, a range expression consists of two characters separated by a hyphen.

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For example [a-dx-z], matches abcd and xyz.

- To include one of the characters \], -, or ^ in a character list, put a \ in front of it. For example:

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– [d\]]

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– matches either d or].

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Character Classes

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- Character classes are a new feature introduced in the POSIX standard.

- A character class is a special notation for describing lists of characters that have a specific attribute.

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Class	Meaning
[:alnum:]	Alphanumeric characters.
[:alpha:]	Alphabetic characters.
[:blank:]	Space and tab characters.
[:digit:]	Numeric characters.
[:lower:]	Lowercase alphabetic characters.
[:punct:]	Punctuation characters (characters that are not letters, digits, control characters, or space characters).
[:space:]	Space characters
[:upper:]	Uppercase alphabetic characters.

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How Much Text Matches?

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- Consider the following:

```
echo aaaabcd | awk '{ sub(/a+/,"<A>"); print }'
```

This example uses the `sub` function to make a change to the input record. Here, the regexp `/a+/` indicates “one or more a characters,” and the replacement text is `<A>`.

- `awk` regular expressions always match the leftmost, longest sequence of input characters that can match.

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Reading Input Files

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- A typical `awk` program either reads from the Standard input or from a file.

- The input is read in units called **records**, and is processed by the rules of your program one record at a time.

- By default, each record is one line. Each record is automatically split into chunks called **fields**.

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How Input Is Split into Records

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- The awk utility divides the input for your awk program into records and fields.

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- awk keeps track of the number of records that have been read from the current input file. This value is stored in a built-in variable called **FNR**.

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- Records are separated by a character called **the record separator**.

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Changing the Record Separator

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- The record separator is maintained in an Environment variable known as RS.

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- Example

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```
awk 'BEGIN { RS = "/" }' BBS-list
```

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- Another way to change the RS:

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- awk '{ print \$0 }' RS="/" BBS-list

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Examining Fields

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- The purpose of fields is to make it more convenient for you to refer to these pieces of the record.

- A dollar-sign (**\$**) is used to refer to a field in an awk program, followed by the number of the field you want.

- **NF** is a built-in variable whose value is the number of fields in the current record.

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- The use of **\$0**, which looks like a reference to the “zero-th” field, is a special case:

— it represents the whole input record when you are not interested in specific fields.

- Here are some more examples:
 - `$ awk '$1 ~ /foo/ { print $0 }'` BBS-list

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Another Example

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- By contrast, the following example looks for foo in the entire record and prints the first field and the last field for each matching input record:

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– \$ awk '/foo/ { print \$1, \$NF }' BBS-list

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Non-constant Field Numbers

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- The number of a field does not need to be a constant. Any expression in the awk language can be used after a \$ to refer to a field.

• Consider this example:

– awk '{ print \$NR }'

- Recall that NR is the number of records read so far.

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- Here is another example of using expressions as field numbers:

– awk '{ print \${2*2} }' BBS-list

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Changing the Contents of a Field

The contents of a field, as seen by awk, can be changed within an awk program; this changes what awk perceives as the current input record.

- Consider the following example and its output:

```
$ awk '{ nboxes = $3 ; $3 = $3 - 10  
>     print nboxes, $3 }' inventory-shipped
```

The output of the above command is:

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- It is also possible to also assign contents to fields that are out of range. For example:

```
$ awk '$6 = ($5 + $4 + $3 + $2);  
      print $6 }' inventory-shipped
```

The output of the above command is:

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The print Statement

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- The print statement is used to produce output with simple, standardized formatting.

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Examples of print Statements

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- Printing With escape sequences.

```
-$ awk 'BEGIN { print "line one\nline two\nline
three" }'
```

- The next example, which is run on the inventory-shipped file, prints the first two fields of each input record, with a space between them:

```
-$ awk '{ print $1, $2 }' inventory-shipped
```

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- A common mistake is omitting the comma.

```
-$ awk '{ print $1 $2 }' inventory-shipped
```

- Adding Headings:

```
awk 'BEGIN{ print "Month Crates"
print "-----" }'
```

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Output Separators

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- The variable **OFS (Output field separator)** is used for specifying the output separator.

- Each print statement outputs one output record, and then outputs a string called the **output record separator (or ORS)**.

- You can change the value of these variables to define your own separators.

- Example:

```
$ awk 'BEGIN { OFS = ";" ; ORS = "\n\n" }
      > { print $1, $2 }' BBS-list
```

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Introduction to the printf Statement

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- A simple printf statement looks like this:

```
printf format, item1, item2, ...
```

- The output separator variables OFS and ORS have no effect on printf statements. For example:

```
$ awk 'BEGIN {
      > ORS= "\nOUCH!\n"; OFS="+"}
      >   msg = "Dont Panic!"
      >   printf "%s\n", msg
      > }'
```

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Format-Control Letters

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- **%c** This prints a number as an ASCII character;
- **%d, %i** These are equivalent; they both print a decimal integer.
- **%e, %E** These print a number in scientific (exponential) notation; for example:
– printf "%4.3e\n", 1950

• **%f** This prints a number in floating-point notation. For example:
– printf "%4.3f", 1950

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Modifiers for printf Formats

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- A format specification can also include

modifiers that can control how much of the item's value is printed, as well as how much space it gets.

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Types of Modifiers

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- N \$ An integer constant followed by a \$ is a positional specifier. This decides the order of printing.

- Example:

– printf "%s %s\n", "don't", "panic"

– printf "%2\$s %1\$s\n", "panic", "don't"

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- - The minus sign, used before the width modifier, says to left-justify the argument within its specified width.

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- + The plus sign, used before the width modifier, says to always supply a sign for numeric conversions.

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ORANE LABS Examples Using printf ORANE LABS ORANE LABS

- The following is a simple example of how to use printf to make an aligned table:

```
ORANE LABS awk '{ printf "%-10s %s\n", $1, $2 }' BBS-list ORANE LABS
```

- Mixing print and printf statements:

```
ORANE LABS awk 'BEGIN{ print "Name\t\tNumber" }  
print "-----"  
{ printf "%-10s %s\n", $1, $2 }' BBS-list ORANE LABS
```

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ORANE LABS Redirecting Output of print and printf ORANE LABS ORANE LABS

- print items>output-file**
- This type of redirection prints the items into the output file named output-file. The filename output-file can be any expression.
- Example:**
 - \$ awk '{ print \$2 > "phone-list" }' BBS-list
 - > print \$1 > "name-list" }

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- **print items>>output-file**

— This type of redirection prints the items into the pre-existing output file named output-file.

- **print items|command**

— It is also possible to send output to a program through a pipe instead of into a file.

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```
awk '{ print $1 > "names.unsorted"
      command = "sort -r > names.sorted"
      print $1 | command }' BBS-list
```

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gawk

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gawk [options] [program] [file-list]

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— gawk [options] –f program-file [file-list]

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Language Basics

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- A gawk program consists of one or more lines containing a pattern and/or action in the following format:

— pattern { action }

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Examples

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\$ cat cars

plym	fury	1970	73	2500
chevy	malibu	1999	60	3000
ford	mustang	1965	45	10000
volvo	s80	1998	102	9850
ford	thundbd	2003	15	10500
chevy	malibu	2000	50	3500
bmw	325i	1985	115	450
honda	accord	2001	30	6000
ford	taurus	2004	10	17000
toyota	rav4	2002	180	750
chevy	impala	1985	85	1550
ford	explor	2003	25	9500

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- A simple gawk program is
 - { print }

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SIIC \$ gawk '{ print }' cars

plym	fury	1970	73	2500
chevy	malibu	1999	60	3000
ford	mustang	1965	45	10000
volvo	s80	1998	102	9850

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Printing Using a Pattern

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- In this case gawk selects from the input just those lines that contain the string **chevy**.

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SIIC II

\$ gawk '/chevy/' cars

chevy	malibu	1999	60	3000
chevy	malibu	2000	50	3500
ORAN	chevy	impala	1985	85

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Selecting Specific fields

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- This example displays the third field (\$3), a SPACE (the output field separator, indicated by the comma), and the first field (\$1)

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1970 plym
1999 chevy
1965 ford
1998 volvo

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\$ gawk '/chevy/ {print \$3, \$1}' cars
1999 chevy
2000 chevy
1985 chev

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~ The matches Operator

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- The next pattern uses the matches operator (~) to select all lines that contain the letter h in the first field:

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\$ gawk '\$1 ~ /h/' cars
chevy malibu 1999 60 3000
chevy malibu 2000 50 3500
honda accord 2001 30 6000
chevy impala 1985 85 1550

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\$ gawk '\$3 == 1985' cars

bmw	325i	1985	115	450
chevy	impala	1985	85	1550

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The next example finds all cars priced at or less than \$3,000.

WV

\$ gawk '\$5 <= 3000' cars

plym	fury	1970	73	2500
chevy	malibu	1999	60	3000
bmw	325i	1985	115	450
toyota	rav4	2002	180	750
chevy	impala	1985	85	1550

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• The range operator (,) selects a group of lines.

• If no line matches the pattern after the

comma, gawk selects every line through the

end of the input.

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• The sed editor is called a stream editor, as opposed to a normal interactive text editor.

• The sed editor can manipulate data in a data stream based on commands you either enter into the command line or store in a command text file.

• It reads one line of data at a time from the input,

matches that data with the supplied editor commands, changes data in the stream as

specified in the commands, then outputs the new data to STDOUT.

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— sed options script file

— sed options script file

— sed options script file

O

— sed options script file

— sed options script file

The sed Command Options

SI	Option	Description	R
WV	-e script	Add commands specified in the script to the commands run while processing the input.	om
O	-f file	Add the commands specified in the file to the commands run while processing the input.	S
SI	-n	Don't produce output for each command, but wait for the print command.	JR

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— echo "This is a test" | sed 's/test/big test/'

— This is a big test

— This is a big test

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You Can also act on data files

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— The quick brown fox jumps over the lazy dog.

— The quick brown fox jumps over the lazy dog.

— The quick brown fox jumps over the lazy dog.

— The quick brown fox jumps over the lazy dog.

• \$ sed 's/dog/cat/' data1

— The quick brown fox jumps over the lazy cat.

— The quick brown fox jumps over the lazy cat.

— The quick brown fox jumps over the lazy cat.

— The quick brown fox jumps over the lazy cat.

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Important
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• It's important to note that the sed editor

doesn't modify the data in the text file itself. It
only sends the modified text to STDOUT.

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Using multiple editor commands in the command line

- To execute more than one command from the sed command line, just use the -e option:

```
$ sed -e 's/brown/green/; s/dog/cat/' data1
```

- The quick green fox jumps over the lazy cat.
- The quick green fox jumps over the lazy cat.
- The quick green fox jumps over the lazy cat.
- The quick green fox jumps over the lazy cat.

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A second technique

```
$ sed -e'  
> s/brown/green/  
> s/fox/elephant/  
> s/dog/cat/' data1
```

- The quick green elephant jumps over the lazy cat.
- The quick green elephant jumps over the lazy cat.
- The quick green elephant jumps over the lazy cat.
- The quick green elephant jumps over the lazy cat.

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Substitution flags

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- The `s` command is used for substituting texts.
- The substitution flag is set after the substitution command strings:

— `s/pattern/replacement/flags`

- There are four types of substitution flags available:
- A number, indicating the pattern occurrence for which new text should be substituted.

— `g` — Indicates that new text should be substituted for all occurrences of the existing text.

- `p` — Indicates that the contents of the original line should be printed.
- `w file` — Write the results of the substitution to a file.

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Example

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- The First Flag:
- `$ sed 's/test/trial/2' data4`
 - This is a test of the trial script.
 - This is the second test of the trial script.

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- The second flag `g`:
- `$ sed 's/test/trial/g' data4`
 - This is a trial of the trial script.
 - This is the second trial of the trial script.

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— `$`

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• The p flag:
– \$ sed -n 's/test/trial/p' data5

ORANE LABS – This is a trial line.

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• The w flag:
– \$ sed 's/test/trial/w test' data5
– This is a trial line.
– This is a different line.

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• Suppose you have the following data in file:
– /bin/csh

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• And you want to replace it with /bin/bash

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• Since forward slash have special meanings, a

different technique is used:

– sed 's!/bin/bash!-/bin/csh!' file.

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• The p flag:
– \$ sed -n 's/test/trial/p' data5

ORANE LABS – This is a trial line.

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• The w flag:
– \$ sed 's/test/trial/w test' data5

– This is a trial line.

– This is a different line.

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• Suppose you have the following data in file:
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- If you only want to apply a command to a specific line, or a group of lines, you must use line addressing.

- There are two forms of line addressing in the sed editor:

- A numeric range of lines
- A text pattern that filters out a line

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Basic Syntax

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- Both forms use the same format for specifying the address:

— [address]command

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Numeric line addressing

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- With this addressing you specify the line number where you want to apply the changes:

\$ sed '2s/dog/cat/' data1

The quick brown fox jumps over the lazy dog

The quick brown fox jumps over the lazy cat

The quick brown fox jumps over the lazy dog

The quick brown fox jumps over the lazy dog

\$

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Specifying a range

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- \$ sed '2,3s/dog/cat/' data1

The quick brown fox jumps over the lazy dog

The quick brown fox jumps over the lazy cat

The quick brown fox jumps over the lazy cat

The quick brown fox jumps over the lazy dog

\$

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Specifying the minimum line number

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- \$ sed '2,\$s/dog/cat/' data1

The quick brown fox jumps over the lazy dog

The quick brown fox jumps over the lazy cat

The quick brown fox jumps over the lazy cat

The quick brown fox jumps over the lazy cat

\$

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Using text pattern filters

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- The sed editor allows you to specify a text

pattern that it uses to filter lines for the
SIIC command.

- The format for this is:

– /pattern/command

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Deleting lines

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Examples

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Specifying a pattern

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- \$ sed '/number 3/c\'

> This is a changed line of text.' data6

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This is line number 2.

This is a changed line of text.

This is line number 4.

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The transform command

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- The transform command (y) is the only sed

editor command that operates on a single

character. The transform command uses the

format:

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— [address]y/inchars/outchars/

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Example

• \$ sed 'y/123/789/' data7

This is line number 7.

This is line number 8.

This is line number 9.

This is line number 4.

This is line number 7 again.

This is yet another line.

This is the last line in the file.

• \$

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Writing to a file

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• The w command is used to write lines to a file.

The format for the w command is:

— [address]w filename

• Here's an example that prints only the first two lines of a data stream to a text file:

\$ sed '1,2w test' data6

This is line number 1.

This is line number 2.

This is line number 3.

This is line number 4.

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- The format of the read command is:

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— [address]r filename

- Example:

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