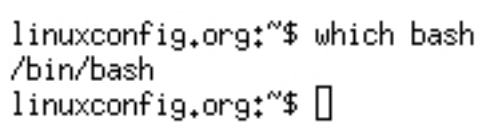
Bash scripting Tutorial

1. Hello World Bash Shell Script

First you need to find out where is your bash interpreter located. Enter the following into your command line:

```
$ which bash
```



Open up you favorite text editor and a create file called hello_world.sh. Insert the following lines to a file:

NOTE:Every bash shell script in this tutorial starts with **shebang:"#!"** which is not read as a comment. First line is also a place where you put your interpreter which is in this case: /bin/bash.

Here is our first bash shell script example:

```
#!/bin/bash
# declare STRING variable
STRING="Hello World"
#print variable on a screen
echo $STRING
```

Navigate to a directory where your hello_world.sh is located and make the file executable:

```
$ chmod +x hello_world.sh
```

```
linuxconfig.org:~$ chmod +x hello_world.sh
linuxconfig.org:~$
```

Now you are ready to execute your first bash script:

```
linuxconfig.org ~$ ./hello_world.sh
Hello World
linuxconfig.org ~$
```

2. Simple Backup bash shell script

```
#!/bin/bash
tar -czf myhome_directory.tar.gz /home/linuxconfig
```

```
linuxconfig.org:~$ ./backup.sh
tar: Removing leading `/' from member names
linuxconfig.org:~$ ls myhome_directory.tar.gz
myhome_directory.tar.gz
linuxconfig.org:~$
```

3. Variables

In this example we declare simple bash variable and print it on the screen (stdout) with echo command.

```
#!/bin/bash
 STRING="HELLO WORLD!!!"
 echo $STRING
```

```
linuxconfig.org:~$ ./hello_world.sh
HELLO WORLD!!!
linuxconfig.org:~$
```

Your backup script and variables:

```
#!/bin/bash
 OF=myhome_directory_$(date +%Y%m%d).tar.gz
```

```
tar -czf $OF /home/linuxconfig
```

```
linuxconfig.org:~$ ./backup.sh
tar: Removing leading `/' from member names
linuxconfig.org:~$ ls myhome_directory_20070521.tar.gz
myhome_directory_20070521.tar.gz
linuxconfig.org:~$
```

3.1. Global vs. Local variables

```
#!/bin/bash
#Define bash global variable
#This variable is global and can be used anywhere in this bash script
VAR="global variable"
function bash {
#Define bash local variable
#This variable is local to bash function only
local VAR="local variable"
echo $VAR
}
echo $VAR
bash
# Note the bash global variable did not change
# "local" is bash reserved word
echo $VAR
```

```
linuxconfig.org$ ./variables.sh
global variable
local variable
global variable
linuxconfig.org$
```

4. Passing arguments to the bash script

```
#!/bin/bash
# use predefined variables to access passed arguments
#echo arguments to the shell
echo $1 $2 $3 ' -> echo $1 $2 $3'

# We can also store arguments from bash command line in special array
args=("$@")
#echo arguments to the shell
echo ${args[0]} ${args[1]} ${args[2]} ' -> args=("$@"); echo ${args[0]

#use $@ to print out all arguments at once
```

```
echo $@ ' -> echo $@'

# use $# variable to print out
# number of arguments passed to the bash script
echo Number of arguments passed: $# ' -> echo Number of arguments pass
```

```
/arguments.sh Bash Scripting Tutorial
```

```
linuxconfig.org$ ./arguments.sh Bash Scripting Tutorial
Bash Scripting Tutorial  -> echo $1 $2 $3
Bash Scripting Tutorial  -> args=("$@"); echo ${args[0]} ${args[1]} ${args[2]}
Bash Scripting Tutorial  -> echo $@
Number of arguments passed: 3  -> echo Number of arguments passed: $#
linuxconfig.org$
```

5. Executing shell commands with bash

```
#!/bin/bash
# use backticks " ` ` " to execute shell command
echo `uname -o`
# executing bash command without backticks
echo uname -o
```

```
linuxconfig.org$ uname -o
GNU/Linux
linuxconfig.org$ ./bash_backticks.sh
GNU/Linux
uname -o
linuxconfig.org$
```

6. Reading User Input

```
#!/bin/bash

echo -e "Hi, please type the word: \c "
read  word
echo "The word you entered is: $word"
echo -e "Can you please enter two words? "
read word1 word2
echo "Here is your input: \"$word1\" \"$word2\""
echo -e "How do you feel about bash scripting? "
# read command now stores a reply into the default build-in variable $
read
echo "You said $REPLY, I'm glad to hear that! "
echo -e "What are your favorite colours ? "
```

```
# -a makes read command to read into an array
read -a colours
echo "My favorite colours are also ${colours[0]}, ${colours[1]} and ${
```

```
linuxconfig.org$ ./read.sh
Hi, please type the word: linuxconfig.org
The word you entered is: linuxconfig.org
Can you please enter two words?
Debian Linux
Here is your input: "Debian" "Linux"
How do you feel about bash scripting?
good
You said good, I'm glad to hear that!
What are your favorite colours ?
blue green black
My favorite colours are also blue, green and black:-)
linuxconfig.org$
```

7. Bash Trap Command

```
#!/bin/bash
# bash trap command
trap bashtrap INT
# bash clear screen command
clear;
# bash trap function is executed when CTRL-C is pressed:
# bash prints message => Executing bash trap subrutine !
bashtrap()
{
    echo "CTRL+C Detected !...executing bash trap !"
}
# for loop from 1/10 to 10/10
for a in `seq 1 10`; do
    echo "$a/10 to Exit."
    sleep 1;
done
echo "Exit Bash Trap Example!!!"
```

8. Arrays

8.1. Declare simple bash array

```
#!/bin/bash
#Declare array with 4 elements
ARRAY=( 'Debian Linux' 'Redhat Linux' Ubuntu Linux )
# get number of elements in the array
ELEMENTS=${#ARRAY[@]}
```

```
# echo each element in array
# for loop
for (( i=0;i<$ELEMENTS;i++)); do
    echo ${ARRAY[${i}]}
done
```

```
linuxconfig.org$ ./arrays
Debian Linux
Redhat Linux
Ubuntu
Linux
linuxconfig.org$
```

8.2. Read file into bash array

```
#!/bin/bash
# Declare array
declare -a ARRAY
# Link filedescriptor 10 with stdin
exec 10<&0
# stdin replaced with a file supplied as a first argument
exec < $1
let count=0

while read LINE; do

    ARRAY[$count]=$LINE
    ((count++))
done

echo Number of elements: ${#ARRAY[@]}
# echo array's content
echo ${ARRAY[@]}
# restore stdin from filedescriptor 10
# and close filedescriptor 10
exec 0<&10 10<&-
```

Bash script execution with an output:

```
linuxconfig.org $ cat bash.txt
Bash
Scripting
Tutorial
```

```
Guide
linuxconfig.org $ ./bash-script.sh bash.txt
Number of elements: 4
Bash Scripting Tutorial Guide
linuxconfig.org $
```

9. Bash if / else / fi statements

9.1. Simple Bash if/else statement

Please note the spacing inside the [and] brackets! Without the spaces, it won't work!

```
#!/bin/bash
directory="./BashScripting"

# bash check if directory exists
if [ -d $directory ]; then
        echo "Directory exists"
else
        echo "Directory does not exists"
fi
```

```
linuxconfig.org ~$ ./bash_if_else.sh
Directory does not exists
linuxconfig.org ~$ mkdir BashScripting
linuxconfig.org ~$ ./bash_if_else.sh
Directory exists
linuxconfig.org ~$
```

9.2. Nested if/else

```
#!/bin/bash

# Declare variable choice and assign value 4
choice=4
# Print to stdout
 echo "1. Bash"
 echo "2. Scripting"
 echo "3. Tutorial"
 echo -n "Please choose a word [1,2 or 3]? "
# Loop while the variable choice is equal 4
# bash while loop
```

```
while [ $choice -eq 4 ]; do

# read user input
read choice
# bash nested if/else
if [ $choice -eq 1 ] ; then

        echo "You have chosen word: Bash"

else

        if [ $choice -eq 2 ] ; then
                 echo "You have chosen word: Scripting"
        else

                if [ $choice -eq 3 ] ; then
                        echo "You have chosen word: Tutorial"
                else
                        echo "Please make a choice between 1-3 !"
                        echo "1. Bash"
                        echo "2. Scripting"
                        echo "3. Tutorial"
                        echo -n "Please choose a word [1,2 or 3]? "
                        choice=4
                fi
        fi
fi
done
```

```
linuxconfig.org ~$ ./nested_if_else.sh
1. Bash
2. Scripting
3. Tutorial
Please choose a word [1,2 or 3]? 5
Please make a choice between 1-3 !
1. Bash
2. Scripting
3. Tutorial
Please choose a word [1,2 or 3]? 2
You have chosen word: Scripting
linuxconfig.org ~$
```

10. Bash Comparisons

10.1. Arithmetic Comparisons

-lt	<
-gt	>

-le	<=
-ge	>=
-eq	==
-ne	!=

```
#!/bin/bash
# declare integers
NUM1=2
NUM2=2
if [ $NUM1 -eq $NUM2 ]; then
        echo "Both Values are equal"
else
        echo "Values are NOT equal"
fi
```

```
linuxconfig.org:~$ ./statement.sh
Both Values are equal
linuxconfig.org:~$
```

```
#!/bin/bash
# declare integers
NUM1=2
NUM2=1
if [ $NUM1 -eq $NUM2 ]; then
        echo "Both Values are equal"
else
        echo "Values are NOT equal"
fi
```

```
linuxconfig.org:~$ ./statement.sh
Values are NOT equal
linuxconfig.org:~$
```

```
#!/bin/bash
# declare integers
NUM1=2
NUM2=1
if   [ $NUM1 -eq $NUM2 ]; then
        echo "Both Values are equal"
elif [ $NUM1 -gt $NUM2 ]; then
        echo "NUM1 is greater then NUM2"
else
```

```
        echo "NUM2 is greater then NUM1"
fi
```

```
linuxconfig.org:~$ ./statement.sh
NUM1 is greater then NUM2
linuxconfig.org:~$
```

10.2. String Comparisons

=	equal
!=	not equal
<	less then
>	greater then
-n s1	string s1 is not empty
-z s1	string s1 is empty

```
#!/bin/bash
#Declare string S1
S1="Bash"
#Declare string S2
S2="Scripting"
if [ $S1 = $S2 ]; then
        echo "Both Strings are equal"
else
        echo "Strings are NOT equal"
fi
```

```
linuxconfig.org:~$ ./statement.sh
Strings are NOT equal
linuxconfig.org:~$
```

```
#!/bin/bash
#Declare string S1
S1="Bash"
#Declare string S2
S2="Bash"
if [ $S1 = $S2 ]; then
        echo "Both Strings are equal"
else
        echo "Strings are NOT equal"
fi
```

```
linuxconfig.org:~$ ./statement.sh
Both Strings are equal
linuxconfig.org:~$
```

11. Bash File Testing

-b filename	Block special file
-c filename	Special character file
-d directoryname	Check for directory existence
-e filename	Check for file existence
-f filename	Check for regular file existence not a directory
-G filename	Check if file exists and is owned by effective group ID.
-g filename	true if file exists and is set-group-id.
-k filename	Sticky bit
-L filename	Symbolic link
-O filename	True if file exists and is owned by the effective user id.
-r filename	Check if file is a readable
-S filename	Check if file is socket
-s filename	Check if file is nonzero size
-u filename	Check if file set-ser-id bit is set
-w filename	Check if file is writable
-x filename	Check if file is executable

```
#!/bin/bash
file="./file"
if [ -e $file ]; then
        echo "File exists"
else
        echo "File does not exists"
fi
```

```
linuxconfig.org:~$ ./filetesting.sh
File does not exists
linuxconfig.org:~$

linuxconfig.org:~$ touch file
linuxconfig.org:~$ ls
file  filetesting.sh
linuxconfig.org:~$ ./filetesting.sh
File exists
linuxconfig.org:~$
```

Similarly for example we can use while loop to check if file does not exists. This script will sleep until file does exists. Note bash negator "!" which negates the -e option.

```
#!/bin/bash

while [ ! -e myfile ]; do
# Sleep until file does exists/is created
sleep 1
done
```

12. Loops

12.1. Bash for loop

```
#!/bin/bash

# bash for loop
for f in $( ls /var/ ); do
        echo $f
done
```

Running for loop from bash shell command line:

```
$ for f in $( ls /var/ ); do echo $f; done
```

```
linuxconfig.org:~$ ./for_loop.sh
backups
cache
lib
local
lock
log
mail
opt
run
spool
tmp
linuxconfig.org:~$
```

12.2. Bash while loop

```
#!/bin/bash
COUNT=6
# bash while loop
while [ $COUNT -gt 0 ]; do
        echo Value of count is: $COUNT
        let COUNT=COUNT-1
done
```

```
linuxconfig.org:~$ ./while_loop.sh
Value of count is: 6
Value of count is: 5
Value of count is: 4
Value of count is: 3
Value of count is: 2
Value of count is: 1
linuxconfig.org:~$
```

12.3. Bash until loop

```
#!/bin/bash
COUNT=0
# bash until loop
until [ $COUNT -gt 5 ]; do
        echo Value of count is: $COUNT
        let COUNT=COUNT+1
done
```

```
linuxconfig.org:~$ ./until_loop.sh
Value of count is: 0
Value of count is: 1
Value of count is: 2
Value of count is: 3
Value of count is: 4
Value of count is: 5
linuxconfig.org:~$
```

12.4. Control bash loop with

Here is a example of while loop controlled by standard input. Until the redirection chain from STDOUT to STDIN to the read command exists the while loop continues.

```
#!/bin/bash
# This bash script will locate and replace spaces
# in the filenames
DIR="."
```

```
# Controlling a loop with bash read command by redirecting STDOUT as
# a STDIN to while loop
# find will not truncate filenames containing spaces
find $DIR -type f | while read file; do
# using POSIX class [:space:] to find space in the filename
if [[ "$file" = *[[:space:]]* ]]; then
# substitute space with "_" character and consequently rename the file
mv "$file" `echo $file | tr ' ' '_'`
fi;
# end of while loop
done
```

```
linuxconfig.org:~$ ls -l
total 4
-rw-r--r-- 1 linuxconfig linuxconfig   0 2008-11-15 19:11 file
-rw-r--r-- 1 linuxconfig linuxconfig   0 2008-11-15 19:11 file with space
-rwxr-xr-x 1 linuxconfig linuxconfig 514 2008-11-15 19:04 script.sh
linuxconfig.org:~$ ./script.sh
linuxconfig.org:~$ ls -l
total 4
-rw-r--r-- 1 linuxconfig linuxconfig   0 2008-11-15 19:11 file
-rw-r--r-- 1 linuxconfig linuxconfig   0 2008-11-15 19:11 file_with_space
-rwxr-xr-x 1 linuxconfig linuxconfig 514 2008-11-15 19:04 script.sh
linuxconfig.org:~$
```

13. Bash Functions

```
!/bin/bash
# BASH FUNCTIONS CAN BE DECLARED IN ANY ORDER
function function_B {
        echo Function B.
}
function function_A {
        echo $1
}
function function_D {
        echo Function D.
}
function function_C {
        echo $1
}
# FUNCTION CALLS
# Pass parameter to function A
function_A "Function A."
function_B
# Pass parameter to function C
function_C "Function C."
function_D
```

```
linuxconfig.org:~$ ./functions.sh
Function A.
Function B.
Function C.
Function D.
linuxconfig.org:~$
```

14. Bash Select

```
#!/bin/bash

PS3='Choose one word: '

# bash select
select word in "linux" "bash" "scripting" "tutorial"
do
  echo "The word you have selected is: $word"
# Break, otherwise endless loop
  break
done

exit 0
```

```
linuxconfig.org ~$ ./select.sh
1) linux
2) bash
3) scripting
4) tutorial
Choose one word: 2
The word you have selected is: bash
linuxconfig.org ~$
```

15. Case statement conditional

```
#!/bin/bash
echo "What is your preferred programming / scripting language"
echo "1) bash"
echo "2) perl"
echo "3) phyton"
echo "4) c++"
echo "5) I do not know !"
read case;
#simple case bash structure
# note in this case $case is variable and does not have to
# be named case this is just an example
case $case in
```

```
    1) echo "You selected bash";;
    2) echo "You selected perl";;
    3) echo "You selected phyton";;
    4) echo "You selected c++";;
    5) exit
esac
```

```
linuxconfig.org$ ./case.sh
What is your preffered programming / scripting language
1) bash
2) perl
3) phyton
4) c++
5) I do not know !
3
You selected phyton
linuxconfig.org$
```

16. Bash quotes and quotations

Quotations and quotes are important part of bash and bash scripting. Here are some bash quotes and quotations basics.

16.1. Escaping Meta characters

Before we start with quotes and quotations we should know something about escaping meta characters. Escaping will suppress a special meaning of meta characters and therefore meta characters will be read by bash literally. To do this we need to use backslash "\" character. Example:

```
#!/bin/bash

#Declare bash string variable
BASH_VAR="Bash Script"

# echo variable BASH_VAR
echo $BASH_VAR

#when meta character such us "$" is escaped with "\" it will be read l
echo \$BASH_VAR

# backslash has also special meaning and it can be suppressed with yet
echo "\\"
```

```
linuxconfig.org$ ./escape_meta.sh
Bash Script
$BASH_VAR
\
linuxconfig.org$
```

16.2. Single quotes

Single quotes in bash will suppress special meaning of every meta characters. Therefore meta characters will be read literally. It is not possible to use another single quote within two single quotes not even if the single quote is escaped by backslash.

```
#!/bin/bash

 #Declare bash string variable
 BASH_VAR="Bash Script"

 # echo variable BASH_VAR
 echo $BASH_VAR

 # meta characters special meaning in bash is suppressed when  using s
 echo '$BASH_VAR  "$BASH_VAR"'
```

```
linuxconfig.org$ ./single_quotes.sh
Bash Script
$BASH_VAR  "$BASH_VAR"
linuxconfig.org$
```

16.3. Double Quotes

Double quotes in bash will suppress special meaning of every meta characters except "$", "\" and "`". Any other meta characters will be read literally. It is also possible to use single quote within double quotes. If we need to use double quotes within double quotes bash can read them literally when escaping them with "\". Example:

```
#!/bin/bash

#Declare bash string variable
BASH_VAR="Bash Script"

# echo variable BASH_VAR
```

```
echo $BASH_VAR

# meta characters and its special meaning in bash is
# suppressed when using double quotes except "$", "\" and "`"

echo "It's $BASH_VAR  and \"$BASH_VAR\" using backticks: `date`"
```

```
linuxconfig.org$ ./double_quotes.sh
Bash Script
It's Bash Script  and "Bash Script" using backticks: Wed Nov 26 11:19:18 EST 2008
linuxconfig.org$
```

16.4. Bash quoting with ANSI-C style

There is also another type of quoting and that is ANSI-C. In this type of quoting characters escaped with "\" will gain special meaning according to the ANSI-C standard.

\a	alert (bell)	\b	backspace
\e	an escape character	\f	form feed
\n	newline	\r	carriage return
\t	horizontal tab	\v	vertical tab
\\	backslash	\`	single quote
\nnn	octal value of characters (see [http://www.asciitable.com/ ASCII table])	\xnn	hexadecimal value of characters (see [http://www.asciitable.com/ ASCII table])

The syntax fo ansi-c bash quoting is: $'' . Here is an example:

```
#!/bin/bash

# as a example we have used \n as a new line, \x40 is hex value for @
# and \56 is octal value for .
echo $'web: www.linuxconfig.org\nemail: web\x40linuxconfig\56org'
```

```
linuxconfig.org$ ./bash_ansi-c.sh
web: www.linuxconfig.org
email: web@linuxconfig.org
linuxconfig.org$
```

17. Arithmetic Operations

17.1. Bash Addition Calculator Example

```
#!/bin/bash

let RESULT1=$1+$2
echo $1+$2=$RESULT1 ' -> # let RESULT1=$1+$2'
declare -i RESULT2
RESULT2=$1+$2
echo $1+$2=$RESULT2 ' -> # declare -i RESULT2; RESULT2=$1+$2'
echo $1+$2=$(($1 + $2)) ' -> # $(($1 + $2))'
```

```
linuxconfig.org$ ./bash_addition_calc.sh 88 12
88+12=100  -> # let RESULT1=$1+$2
88+12=100  -> # declare -i RESULT2; RESULT2=$1+$2
88+12=100  -> # $(($1 + $2))
linuxconfig.org$
```

17.2. Bash Arithmetics

```
#!/bin/bash

echo '### let ###'
# bash addition
let ADDITION=3+5
echo "3 + 5 =" $ADDITION

# bash subtraction
let SUBTRACTION=7-8
echo "7 - 8 =" $SUBTRACTION

# bash multiplication
let MULTIPLICATION=5*8
echo "5 * 8 =" $MULTIPLICATION

# bash division
let DIVISION=4/2
echo "4 / 2 =" $DIVISION

# bash modulus
let MODULUS=9%4
echo "9 % 4 =" $MODULUS
```

```
# bash power of two
let POWEROFTWO=2**2
echo "2 ^ 2 =" $POWEROFTWO


echo '### Bash Arithmetic Expansion ###'
# There are two formats for arithmetic expansion: $[ expression ]
# and $(( expression #)) its your choice which you use

echo 4 + 5 = $((4 + 5))
echo 7 - 7 = $[ 7 - 7 ]
echo 4 x 6 = $((3 * 2))
echo 6 / 3 = $((6 / 3))
echo 8 % 7 = $((8 % 7))
echo 2 ^ 8 = $[ 2 ** 8 ]


echo '### Declare ###'

echo -e "Please enter two numbers \c"
# read user input
read num1 num2
declare -i result
result=$num1+$num2
echo "Result is:$result "

# bash convert binary number 10001
result=2#10001
echo $result

# bash convert octal number 16
result=8#16
echo $result

# bash convert hex number 0xE6A
result=16#E6A
echo $result
```

```
linuxconfig.org$ ./arithmetic_operations.sh
### let ###
3 + 5 = 8
7 - 8 = -1
5 * 8 = 40
4 / 2 = 2
9 % 4 = 1
2 ^ 2 = 4
### Bash Arithmetic Expansion ###
4 + 5 = 9
7 - 7 = 0
4 x 6 = 6
6 / 3 = 2
8 % 7 = 1
2 ^ 8 = 256
### Declare ###
Please enter two numbers 23 45
Result is:68
17
14
3690
linuxconfig.org$
```

17.3. Round floating point number

```
#!/bin/bash
# get floating point number
floating_point_number=3.3446
echo $floating_point_number
# round floating point number with bash
for bash_rounded_number in $(printf %.0f $floating_point_number); do
echo "Rounded number with bash:" $bash_rounded_number
done
```

```
linuxconfig.org:~$ ./round.sh
3.3446
Rounded number with bash: 3
linuxconfig.org:~$
```

17.4. Bash floating point calculations

```
#!/bin/bash
# Simple linux bash calculator
echo "Enter input:"
read userinput
echo "Result with 2 digits after decimal point:"
echo "scale=2; ${userinput}" | bc
echo "Result with 10 digits after decimal point:"
echo "scale=10; ${userinput}" | bc
echo "Result as rounded integer:"
echo $userinput | bc
```

```
linuxconfig.org:~$ ./simple_bash_calc.sh
Enter input:
10/3.4
Result with 2 digits after decimal point:
2.94
Result with 10 digits after decimal point:
2.9411764705
Result as rounded integer:
2
linuxconfig.org:~$
```

18. Redirections

18.1. STDOUT from bash script to STDERR

```
#!/bin/bash

 echo "Redirect this STDOUT to STDERR" 1>&2
```

To prove that STDOUT is redirected to STDERR we can redirect script's output to file:

```
linuxconfig.org$ ./redirecting.sh
Redirect this STDOUT to STDERR
linuxconfig.org$
linuxconfig.org$ ./redirecting.sh > STDOUT.txt
Redirect this STDOUT to STDERR
linuxconfig.org$ cat STDOUT.txt
linuxconfig.org$
linuxconfig.org$ ./redirecting.sh 2> STDERR.txt
linuxconfig.org$ cat STDERR.txt
Redirect this STDOUT to STDERR
linuxconfig.org$
```

18.2. STDERR from bash script to STDOUT

```
#!/bin/bash

 cat $1 2>&1
```

To prove that STDERR is redirected to STDOUT we can redirect script's output to file:

```
linuxconfig.org$ ./redirecting.sh /etc/shadow
cat: /etc/shadow: Permission denied
linuxconfig.org$
linuxconfig.org$ ./redirecting.sh /etc/shadow > STDOUT.txt
linuxconfig.org$ cat STDOUT.txt
cat: /etc/shadow: Permission denied
linuxconfig.org$
linuxconfig.org$ ./redirecting.sh /etc/shadow 2> STDERR.txt
cat: /etc/shadow: Permission denied
linuxconfig.org$ cat STDERR.txt
linuxconfig.org$
```

18.3. stdout to screen

The simple way to redirect a standard output (stdout) is to simply use any command, because by default stdout is automatically redirected to screen. First create a file "file1":

```
$ touch file1
$ ls file1
file1
```

As you can see from the example above execution of ls command produces STDOUT which by default is redirected to screen.

18.4. stdout to file

The override the default behavior of STDOUT we can use ">" to redirect this output to file:

```
$ ls file1 > STDOUT
$ cat STDOUT
file1
```

18.5. stderr to file

By default STDERR is displayed on the screen:

```
$ ls
file1  STDOUT
$ ls file2
ls: cannot access file2: No such file or directory
```

In the following example we will redirect the standard error (stderr) to a file and stdout to a screen as default. Please note that STDOUT is displayed on the screen, however STDERR is redirected to a file called STDERR:

```
$ ls
file1  STDOUT
$ ls file1 file2 2> STDERR
file1
$ cat STDERR
ls: cannot access file2: No such file or directory
```

18.6. stdout to stderr

It is also possible to redirect STDOUT and STDERR to the same file. In the next example we will redirect STDOUT to the same descriptor as STDERR. Both STDOUT and STDERR will be redirected to file "STDERR_STDOUT".

```
$ ls
file1  STDERR  STDOUT
$ ls file1 file2 2> STDERR_STDOUT 1>&2
$ cat STDERR_STDOUT
ls: cannot access file2: No such file or directory
file1
```

File STDERR_STDOUT now contains STDOUT and STDERR.

18.7. stderr to stdout

The above example can be reversed by redirecting STDERR to the same descriptor as SDTOUT:

```
$ ls
file1  STDERR  STDOUT
$ ls file1 file2 > STDERR_STDOUT 2>&1
$ cat STDERR_STDOUT
```

```
ls: cannot access file2: No such file or directory
file1
```

18.8. stderr and stdout to file

Previous two examples redirected both STDOUT and STDERR to a file. Another way to achieve the same effect is illustrated below:

```
$ ls
file1  STDERR  STDOUT
$ ls file1 file2 &> STDERR_STDOUT
$ cat STDERR_STDOUT
ls: cannot access file2: No such file or directory
file1
```

or

```
ls file1 file2 >& STDERR_STDOUT
$ cat STDERR_STDOUT
ls: cannot access file2: No such file or directory
file1
```