Shell Types

In Unix, there are two major types of shells −

* **Bourne shell** − If you are using a Bourne-type shell, the **$** character is the default prompt.
* **C shell** − If you are using a C-type shell, the % character is the default prompt.

The Bourne Shell has the following subcategories −

* Bourne shell (sh)
* Korn shell (ksh)
* Bourne Again shell (bash)
* POSIX shell (sh)

The different C-type shells follow −

* C shell (csh)
* TENEX/TOPS C shell (tcsh)

Assume we create a **test.sh** script. Note all the scripts would have the **.sh**extension. Before you add anything else to your script, you need to alert the system that a shell script is being started. This is done using the **shebang**construct. For example −

#!/bin/sh

This tells the system that the commands that follow are to be executed by the Bourne shell. *It's called a shebang because the****#****symbol is called a hash, and the ! symbol is called a bang*.

To create a script containing these commands, you put the shebang line first and then add the commands −

#!/bin/bash

pwd

ls

You can put your comments in your script as follows −

#!/bin/bash

# Author : Zara Ali

# Copyright (c) Tutorialspoint.com

# Script follows here:

pwd

ls

Save the above content and make the script executable −

$chmod +x test.sh

The shell script is now ready to be executed −

$./test.sh

Upon execution, you will receive the following result −

/home/amrood

index.htm unix-basic\_utilities.htm unix-directories.htm

test.sh unix-communication.htm unix-environment.htm

The shell is, after all, a real programming language, complete with variables, control structures, and so forth. No matter how complicated a script gets, it is still just a list of commands executed sequentially.

The following script uses the **read** command which takes the input from the keyboard and assigns it as the value of the variable PERSON and finally prints it on STDOUT.

#!/bin/sh

# Author : Zara Ali

# Copyright (c) Tutorialspoint.com

# Script follows here:

echo "What is your name?"

read PERSON

echo "Hello, $PERSON"

Here is a sample run of the script −

$./test.sh

What is your name?

Zara Ali

Hello, Zara Ali

$

A variable is a character string to which we assign a value. The value assigned could be a number, text, filename, device, or any other type of data.

A variable is nothing more than a pointer to the actual data. The shell enables you to create, assign, and delete variables.

## Variable Names

The name of a variable can contain only letters (a to z or A to Z), numbers ( 0 to 9) or the underscore character ( \_).

By convention, Unix shell variables will have their names in UPPERCASE.

The following examples are valid variable names −

\_ALI

TOKEN\_A

VAR\_1

VAR\_2

Following are the examples of invalid variable names −

2\_VAR

-VARIABLE

VAR1-VAR2

VAR\_A!

The reason you cannot use other characters such as **!**, **\***, or **-** is that these characters have a special meaning for the shell.

## Defining Variables

Variables are defined as follows −

variable\_name=variable\_value

For example −

NAME="Zara Ali"

The above example defines the variable NAME and assigns the value "Zara Ali" to it. Variables of this type are called **scalar variables**. A scalar variable can hold only one value at a time.

Shell enables you to store any value you want in a variable. For example −

VAR1="Zara Ali"

VAR2=100

## Accessing Values

To access the value stored in a variable, prefix its name with the dollar sign (**$**) −

For example, the following script will access the value of defined variable NAME and print it on STDOUT −

#!/bin/sh

NAME="Zara Ali"

echo $NAME

The above script will produce the following value −

Zara Ali

Read-only Variables

Shell provides a way to mark variables as read-only by using the read-only command. After a variable is marked read-only, its value cannot be changed.

For example, the following script generates an error while trying to change the value of NAME −

#!/bin/sh

NAME="Zara Ali"

readonly NAME

NAME="Qadiri"

The above script will generate the following result −

/bin/sh: NAME: This variable is read only.

Unsetting Variables

Unsetting or deleting a variable directs the shell to remove the variable from the list of variables that it tracks. Once you unset a variable, you cannot access the stored value in the variable.

Following is the syntax to unset a defined variable using the **unset** command −

unset variable\_name

The above command unsets the value of a defined variable. Here is a simple example that demonstrates how the command works −

#!/bin/sh

NAME="Zara Ali"

unset NAME

echo $NAME

The above example does not print anything. You cannot use the unset command to **unset** variables that are marked **readonly**.

Variable Types

When a shell is running, three main types of variables are present −

* **Local Variables** − A local variable is a variable that is present within the current instance of the shell. It is not available to programs that are started by the shell. They are set at the command prompt.
* **Environment Variables** − An environment variable is available to any child process of the shell. Some programs need environment variables in order to function correctly. Usually, a shell script defines only those environment variables that are needed by the programs that it runs.
* **Shell Variables** − A shell variable is a special variable that is set by the shell and is required by the shell in order to function correctly. Some of these variables are environment variables whereas others are local variables.

## Exit Status

The $? variable represents the exit status of the previous command.

Exit status is a numerical value returned by every command upon its completion. As a rule, most commands return an exit status of 0 if they were successful, and 1 if they were unsuccessful.

## Accessing Array Values

After you have set any array variable, you access it as follows −

${array\_name[index]}

Here *array\_name* is the name of the array, and *index* is the index of the value to be accessed. Following is an example to understand the concept −

#!/bin/sh

NAME[0]="Zara"

NAME[1]="Qadir"

NAME[2]="Mahnaz"

NAME[3]="Ayan"

NAME[4]="Daisy"

echo "First Index: ${NAME[0]}"

echo "Second Index: ${NAME[1]}"

The above example will generate the following result −

$./test.sh

First Index: Zara

Second Index: Qadir

You can access all the items in an array in one of the following ways −

${array\_name[\*]}

${array\_name[@]}

Here **array\_name** is the name of the array you are interested in. Following example will help you understand the concept −

#!/bin/sh

NAME[0]="Zara"

NAME[1]="Qadir"

NAME[2]="Mahnaz"

NAME[3]="Ayan"

NAME[4]="Daisy"

echo "First Method: ${NAME[\*]}"

echo "Second Method: ${NAME[@]}"

The above example will generate the following result −

$./test.sh

First Method: Zara Qadir Mahnaz Ayan Daisy

Second Method: Zara Qadir Mahnaz Ayan Daisy

We will discuss in detail about Bourne shell (default shell) in this chapter.

We will now discuss the following operators −

* Arithmetic Operators
* Relational Operators
* Boolean Operators
* String Operators
* File Test Operators

Bourne shell didn't originally have any mechanism to perform simple arithmetic operations but it uses external programs, either **awk** or **expr**.

The following example shows how to add two numbers −

#!/bin/sh

val=`expr 2 + 2`

echo "Total value : $val"

The above script will generate the following result −

Total value : 4

The following points need to be considered while adding −

* There must be spaces between operators and expressions. For example, 2+2 is not correct; it should be written as 2 + 2.
* The complete expression should be enclosed between **‘ ‘**, called the inverted commas.

## Arithmetic Operators

The following arithmetic operators are supported by Bourne Shell.

Assume variable **a** holds 10 and variable **b** holds 20 then −

[Show Examples](https://www.tutorialspoint.com/unix/unix-arithmetic-operators.htm)

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| + (Addition) | Adds values on either side of the operator | `expr $a + $b` will give 30 |
| - (Subtraction) | Subtracts right hand operand from left hand operand | `expr $a - $b` will give -10 |
| \* (Multiplication) | Multiplies values on either side of the operator | `expr $a \\* $b` will give 200 |
| / (Division) | Divides left hand operand by right hand operand | `expr $b / $a` will give 2 |
| % (Modulus) | Divides left hand operand by right hand operand and returns remainder | `expr $b % $a` will give 0 |
| = (Assignment) | Assigns right operand in left operand | a = $b would assign value of b into a |
| == (Equality) | Compares two numbers, if both are same then returns true. | [ $a == $b ] would return false. |
| != (Not Equality) | Compares two numbers, if both are different then returns true. | [ $a != $b ] would return true. |

It is very important to understand that all the conditional expressions should be inside square braces with spaces around them, for example **[ $a == $b ]**is correct whereas, **[$a==$b]** is incorrect.

Relational Operators

Bourne Shell supports the following relational operators that are specific to numeric values. These operators do not work for string values unless their value is numeric.

For example, following operators will work to check a relation between 10 and 20 as well as in between "10" and "20" but not in between "ten" and "twenty".

Assume variable **a** holds 10 and variable **b** holds 20 then −

[Show Examples](https://www.tutorialspoint.com/unix/unix-relational-operators.htm)

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| **-eq** | Checks if the value of two operands are equal or not; if yes, then the condition becomes true. | [ $a -eq $b ] is not true. |
| **-ne** | Checks if the value of two operands are equal or not; if values are not equal, then the condition becomes true. | [ $a -ne $b ] is true. |
| **-gt** | Checks if the value of left operand is greater than the value of right operand; if yes, then the condition becomes true. | [ $a -gt $b ] is not true. |
| **-lt** | Checks if the value of left operand is less than the value of right operand; if yes, then the condition becomes true. | [ $a -lt $b ] is true. |
| **-ge** | Checks if the value of left operand is greater than or equal to the value of right operand; if yes, then the condition becomes true. | [ $a -ge $b ] is not true. |
| **-le** | Checks if the value of left operand is less than or equal to the value of right operand; if yes, then the condition becomes true. | [ $a -le $b ] is true. |

## Boolean Operators

The following Boolean operators are supported by the Bourne Shell.

Assume variable **a** holds 10 and variable **b** holds 20 then −

[Show Examples](https://www.tutorialspoint.com/unix/unix-boolean-operators.htm)

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| **!** | This is logical negation. This inverts a true condition into false and vice versa. | [ ! false ] is true. |
| **-o** | This is logical **OR**. If one of the operands is true, then the condition becomes true. | [ $a -lt 20 -o $b -gt 100 ] is true. |
| **-a** | This is logical **AND**. If both the operands are true, then the condition becomes true otherwise false. | [ $a -lt 20 -a $b -gt 100 ] is false. |

## String Operators

The following string operators are supported by Bourne Shell.

Assume variable **a** holds "abc" and variable **b** holds "efg" then −

[Show Examples](https://www.tutorialspoint.com/unix/unix-string-operators.htm)

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| **=** | Checks if the value of two operands are equal or not; if yes, then the condition becomes true. | [ $a = $b ] is not true. |
| **!=** | Checks if the value of two operands are equal or not; if values are not equal then the condition becomes true. | [ $a != $b ] is true. |
| **-z** | Checks if the given string operand size is zero; if it is zero length, then it returns true. | [ -z $a ] is not true. |
| **-n** | Checks if the given string operand size is non-zero; if it is nonzero length, then it returns true. | [ -n $a ] is not false. |
| **str** | Checks if **str** is not the empty string; if it is empty, then it returns false. | [ $a ] is not false. |

## File Test Operators

We have a few operators that can be used to test various properties associated with a Unix file.Assume a variable **file** holds an existing file name "test" the size of which is 100 bytes and has **read**, **write** and **execute** permission on −

[Show Examples](https://www.tutorialspoint.com/unix/unix-file-operators.htm)

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| **-b file** | Checks if file is a block special file; if yes, then the condition becomes true. | [ -b $file ] is false. |
| **-c file** | Checks if file is a character special file; if yes, then the condition becomes true. | [ -c $file ] is false. |
| **-d file** | Checks if file is a directory; if yes, then the condition becomes true. | [ -d $file ] is not true. |
| **-f file** | Checks if file is an ordinary file as opposed to a directory or special file; if yes, then the condition becomes true. | [ -f $file ] is true. |
| **-g file** | Checks if file has its set group ID (SGID) bit set; if yes, then the condition becomes true. | [ -g $file ] is false. |
| **-k file** | Checks if file has its sticky bit set; if yes, then the condition becomes true. | [ -k $file ] is false. |
| **-p file** | Checks if file is a named pipe; if yes, then the condition becomes true. | [ -p $file ] is false. |
| **-t file** | Checks if file descriptor is open and associated with a terminal; if yes, then the condition becomes true. | [ -t $file ] is false. |
| **-u file** | Checks if file has its Set User ID (SUID) bit set; if yes, then the condition becomes true. | [ -u $file ] is false. |
| **-r file** | Checks if file is readable; if yes, then the condition becomes true. | [ -r $file ] is true. |
| **-w file** | Checks if file is writable; if yes, then the condition becomes true. | [ -w $file ] is true. |
| **-x file** | Checks if file is executable; if yes, then the condition becomes true. | [ -x $file ] is true. |
| **-s file** | Checks if file has size greater than 0; if yes, then condition becomes true. | [ -s $file ] is true. |
| **-e file** | Checks if file exists; is true even if file is a directory but exists. | [ -e $file ] is true. |

* [The while loop](https://www.tutorialspoint.com/unix/while-loop.htm)
* [The for loop](https://www.tutorialspoint.com/unix/for-loop.htm)
* [The until loop](https://www.tutorialspoint.com/unix/until-loop.htm)
* [The select loop](https://www.tutorialspoint.com/unix/select-loop.htm)

## Nesting while Loops

It is possible to use a while loop as part of the body of another while loop.

### **Syntax**

while command1 ; # this is loop1, the outer loop

do

Statement(s) to be executed if command1 is true

while command2 ; # this is loop2, the inner loop

do

Statement(s) to be executed if command2 is true

done

Statement(s) to be executed if command1 is true

done

### **Example**

Here is a simple example of loop nesting. Let's add another countdown loop inside the loop that you used to count to nine −

#!/bin/sh

a=0

while [ "$a" -lt 10 ] # this is loop1

do

b="$a"

while [ "$b" -ge 0 ] # this is loop2

do

echo -n "$b "

b=`expr $b - 1`

done

echo

a=`expr $a + 1`

done

This will produce the following result. It is important to note how **echo -n**works here. Here **-n** option lets echo avoid printing a new line character.

0

1 0

2 1 0

3 2 1 0

4 3 2 1 0

5 4 3 2 1 0

6 5 4 3 2 1 0

7 6 5 4 3 2 1 0

8 7 6 5 4 3 2 1 0

9 8 7 6 5 4 3 2 1 0