Agenda

Topic-24: Shell Scripting / Shell Programming:

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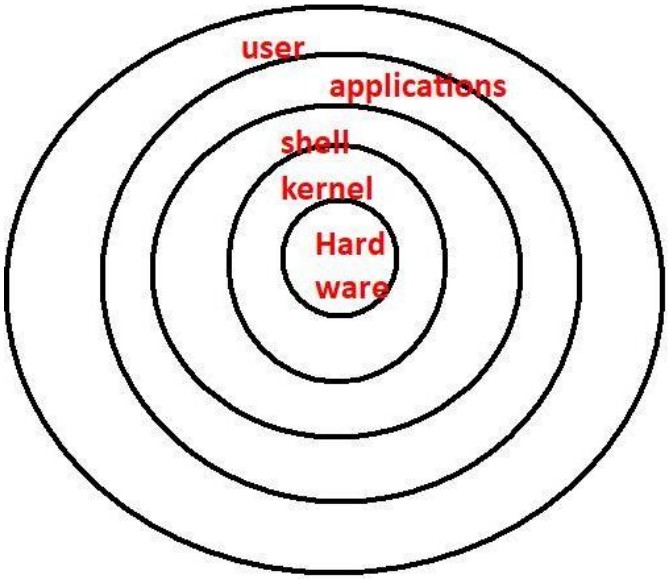
Topic-37: Project on awk programming

Topic-24: What is Shell and Types of Shells

What is Shell?



1) Shell is responsible to read commands/applications provided by user.
2) Shell will check whether command is valid or not and whether it is properly used or not. If everything is proper then shell interpretes (converts) that command into kernel understandable form. That interpreted command will be handover to kernel.
3) Kernel is responsible to execute that command with the help of hardware.

Shell acts as interface between user and kernel.
shell+kernel is nothing but operating system.

Types of Shells:

There are multiple types of shells are available.

1) Bourne Shell:

- It is developed by Stephen Bourne.
- This is the first shell which is developed for UNIX.
- By using sh command we can access this shell.

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2) BASH Shell:

- BASH → Bourne Again SHell.
- It is advanced version of Bourne Shell.
- This is the default shell for most of the linux flavours.
- By using bsh command we can access this shell.

3) Korn Shell:

- It is developed by David Korn.
- Mostly this shell used in IBM AIX operating system.
- By using ksh command, we can access this shell.

4) CShell:

- Developed by Bill Joy.
- C meant for California University.
- It is also by default available with UNIX.
- By using csh command, we can access this shell.

5) TShell:

- T means Terminal.
- It is the advanced version of CShell.
- This is the most commonly used shell in HP UNIX.
- By using tcsh command, we can access this shell.

6) Z Shell:

- Developed by Paul.
- By using zsh command we can access this shell.

Note: The most commonly used shell in linux environment is BASH. It is more powerful than remaining shells.

How to Check Default Shell in our System?

```
$ echo $0
bash
$ echo $SHELL
/bin/bash
```

We can also check the default shell information inside /etc/passwd file

```
$ cat /etc/passwd

durgasoft:x:1000:1000:durgasoft,,,:/home/durgasoft:/bin/bash
```

How to check all available Shells in our System?

/etc/shells file contains all available shells information.

```
$ cat /etc/shells
# /etc/shells: valid login shells
/bin/sh
/bin/bash
/bin/rbash
/bin/dash
```

How to Switch to other Shells?

Based on our requirement we can switch from one shell to another shell.

```
durgasoft@durgasoft:~/Desktop$ sh
$ echo $0
sh
$ exit
durgasoft@durgasoft:~/Desktop$ echo $0
bash
durgasoft@durgasoft:~/Desktop$ rbash
durgasoft@durgasoft:~/Desktop$ echo $0
rbash
durgasoft@durgasoft:~/Desktop$ exit
exit
durgasoft@durgasoft:~/Desktop$ dash
$ echo $0
dash
$ exit
```

Topic-25: What is Shell Script, Sha-Bang and First Script

What is Shell Script:

A sequence of commands saved to a file and this file is nothing but shell script.

Inside shell script, we can also use programming features like conditional statements, loops, functions etc. Hence we can write scripts very easily for complex requirements also.

Best suitable for automated tasks.

How to write and run Shell Script:

Step - 1: Write script

demo.sh:

```
echo "Welcome to shell script"
date
cal
```

Step - 2: Provide execute permissions to the script:

```
$ chmod a+x demo.sh
```

Step - 3: Run the script

We can run the script in multiple ways

```
$ /bin/bash  ./demo.sh
$ bash  ./demo.sh
$ /bin/bash  /home/durgasoft/scripts/demo.sh
$ ./demo.sh     # default shell is bash
```

Note: The default shell is bash. Hence bash is responsible to execute our script. Instead of bash, if we want to use Bourne shell then we have to use the following command

```
$ /bin/sh   ./demo.sh
$ sh   ./demo.sh
```

Importance of Sha-Bang:

By using sha-bang, we can specify the interpreter which is responsible to execute the script.

 # → Sharp
! → Bang
#! → Sharp Bang or Shabang or Shebang

#! /bin/bash → It means the script should be executed by bash
#! /bin/sh → It means the script should be executed by Bourne Shell
#! /usr/bin/python3 → It means the script should be executed by Python3 interpreter

If we write shabang in our script at the time of execution, we are not required to provide command to execute and we can execute script directly.

Q1) Write a Python Script and execute without shabang and with shabang?

test.py

```
#! /usr/bin/python3
import random
name = input("Enter Your Name:")
l =["Sunny","Katrina","Kareena","Mallika","Malaika"]
print("Hello:",name)
print("Congratulations..You are going to marry:",random.choice(l))
```

Without Shabang:

```
$ python3 ./test.py
$ python3 /home/durgasoft/scripts/test.py
```

With Shabang:

```
$ ./test.py
$ /home/durgasoft/scripts/test.py
```

Q2) Consider the folloiwng Script:

demo.sh

```
#! /bin/rm
echo "It is beautiful script"
```

If we execute this script what will happend?

```
$ ./demo.sh
```

It is equivalent to
$ rm ./demo.sh
demo.sh will be removed as this script executed by rm command.

Q3) Write and Run Shell Script that Prints Current System Date and Time

date.sh

```
#! /bin/bash
echo "The current System Date and Time:"
date
```

Provide execute permissions for this script

```
$ chmod a+x date.sh
$./date.sh
```

Q4) How to Run Our Script from any where in our System?

- **For any command or script, by default shell will check locations specified by PATH variable.**

- **If we add our script location to PATH Variable value, then we can run our script from anywhere in our system. We can do this in the following two ways:**

1)Session Level:

```
durgasoft@durgasoft:~/scripts$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:
/snap/bin

$ export PATH=$PATH:/home/durgasoft/scripts

durgasoft@durgasoft:~/scripts$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:
/snap/bin:/home/durgasoft/scripts
```

Now we can run our script from anywhere. We are not required to provide either absolute path or relative path.

```
$date.sh
The current System Date and Time:
Wed Dec  4 21:01:49 IST 2019
```

Note: **This way of setting PATH variable is applicable only for current session. Once we close terminal then automatically these changes will be lost.**

2) Setting PATH permanently at User Level:

- **In our user home directory there is a file named with .bashrc. This file will be executed every time automatically whenever we open the terminal. If we define PATH variable in this file then that PATH value will become permanent and we are not required to set every time.**

- **Add the following line at bottom of this file**

- **export PATH=$PATH:/home/durgasoft/scripts**

Q5) What is the meaning of Startup File?

- **.bashrc is the startup file and will be executed automatically at the time of terminal starting.**
- **Hence if we want to perform any activity while starting the terminal we have to define that activity in this file.**
- **eg: creating aliases and updating PATH variable value etc**

Q6) What is meant by logout File?

- **.bash_logout is logout file and will be executed automatically at the time of terminal exit.**
- **Hence if we want to perform any activity at terminal exit, then we have to define that activity inside this file.**

Topic-26: Shell Variables

Variables are place holders to hold values.
Variables are key-value pairs.
In Shell programming, there are no data types. Every value is treated as text type/ String type.

All variables are divided into 2 types
1) **Environment variables / predefined variables**
2) **User defined variables**

1) Environment Variables:

These are predefined variables and mostly used internally by the system. Hence these variables also known as System variables.
But based on our requirement, we can use these variables in our scripts.

We can get all environment variables information by using either env command or set command.

```
durgasoft@durgasoft:~$ env
LANG=en_IN
USERNAME=durgasoft
USER=durgasoft
PWD=/home/durgasoft
HOME=/home/durgasoft
SHELL=/bin/bash
LOGNAME=durgasoft
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/
games:/snap/bin:/home/durgasoft/scripts
...

durgasoft@durgasoft:~$ set
BASH=/bin/bash
```


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```
LANG=en_IN
LOGNAME=durgasoft
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/
games:/snap/bin:/home/durgasoft/scripts
PS1='\[\e]0;\u@\h:
\w\a\]${debian_chroot:+($debian_chroot)}\[\033[01;32m\]\u@\h\[\033[00m\]:\[\033[0
1;34m\]\w\[\033[00m\]\$ '
PWD=/home/durgasoft
SHELL=/bin/bash
```

How to Change Prompt:

Internally PS1 Environment variable is responsible to display terminal prompt. By reassigning the value we can change prompt.

```
durgasoft@durgasoft:~$
durgasoft@durgasoft:~$ PS1=DURGA$
DURGA$ls
abc.txt  Documents  d.txt  Pictures  scripts   Videos  y
Desktop  Downloads  Music  Public    Templates  x
DURGA$cat > abc.txt
asdfjkasjfdsa
asfdkasklfdjlads
DURGA$PS1=Sunny#
Sunny#ls -l
total 52
-rw-r--r-- 1 durgasoft durgasoft   31 Dec  5 20:58 abc.txt
drwxr-xr-x 2 durgasoft durgasoft 4096 Dec  5 18:04 Desktop
drwxr-xr-x 2 durgasoft durgasoft 4096 Nov 21 17:06 Documents
drwxr-xr-x 2 durgasoft durgasoft 4096 Nov 21 17:06 Downloads
```

Demo Script to Use some Environment Variables:

env.sh

```
#! /bin/bash
echo "User Name: $USER"
echo "User Home Directory: $HOME"
echo "Default Shell Name: $SHELL"
echo "PATH: $PATH"

$chmod 755 env.sh
$./env.sh
User Name: durgasoft
User Home Directory: /home/durgasoft
```


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Default Shell Name: /bin/bash
PATH:
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/durgasoft/scripts

2) User defined Variables:

Based on our programming requirement, we can define our own variables also.

```
durgasoft@durgasoft:~/scripts$ GUEST=Dhoni
durgasoft@durgasoft:~/scripts$ echo "Hello $GUEST You are my Hero"
Hello Dhoni You are my Hero
```

Rules to define Variables:

1) **It is recommended to use only UPPER CASE characters.**
2) **If variable contains multiple words, then these words should be separated with _ symbol.**
3) **Variable names should not starts with digit.**
   ```
   durgasoft@durgasoft:~/scripts$ 123A=40
   123A=40: command not found
   ```
4) **We should not use special symbols like -,@,# etc**

How to define Readonly Variables:

We can define read only variables by using readonly keyword.

```
$A=100
$readonly A
$A=300
bash: A: readonly variable
```

If the variable is readonly then we cannot perform reassignment for that variable.It will become constant.

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Variable Scopes:

There are 3 scopes available for variables.

1) **Session Scope**
2) **User Scope**
3) **System Scope**

1) Session Scope:

The variables which are declared in the terminal are said to be in session scope.
Once we close the terminal (ie exit session) automatically all variables will be gone.

```
$ X=10
$ Y=10
```

2) User Scope:

- **The variables which are declared inside .bashrc file, are said to be in user scope.**
- **These variables are available for all sessions related to current user. These variables cannot be accessed by other users.**

.bashrac

```
....
export GUEST=Dhoni
export FRIEND=Sunny
```

3) System Scope:

If the variable available for all users and for all sessions, such type of variables are said to be in system scope.

We have to declare these variables inside /etc/profile file.
But to edit this file compulsory root permissions must be required.

```
$ sudo gedit /etc/profile
```

```
...
export NAME=DURGA
export COURSE=PYTHON
```

Topic-27: Variable Substitution and Command Substitution

Variable Substitution:

Accessing the value of a variable by using $ symbol is called variable substitution.

Syntax:

```
$variablename
${variablename}
```

Recommended to use ${variablename}.

test.sh

```
#! /bin/bash
a=10
b=20
COURSE="linux"
ACTION="SLEEP"
echo "Values of a and b are: $a  and $b"
echo "My Course is: ${COURSE}"
echo "My Favourite Action: $ACTIONING"
echo "My Favourite Action: ${ACTION}ING"
```

Output:

```
Values of a and b are: 10 and 20
My Course is: linux
My Favourite Action:
My Favourite Action: SLEEPING
```

Q1) Consider the following variable declaration NAME="durga"
Which of the following is valid way to print value of NAME?

A) echo NAME
B) echo $NAME
C) echo '$NAME'
D) echo "$NAME"

Ans: B, D

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Note: If we use single quotes then variable substitution won't be happend. But we can use double quotes.

```
durgasoft@durgasoft:~/scripts$ NAME='durga'
durgasoft@durgasoft:~/scripts$ echo NAME
NAME
durgasoft@durgasoft:~/scripts$ echo $NAME
durga
durgasoft@durgasoft:~/scripts$ echo '$NAME'
$NAME
durgasoft@durgasoft:~/scripts$ echo "$NAME"
durga
```

Command Substitution:

We can execute command and we can substitute its result based on our requirement by using command substitution.

Syntax:

Old style: `command ` These are backquotes butnot single quotes
New Style: $(command)

Eg 1:

```
durgasoft@durgasoft:~/scripts$ echo "Today Date is: `date +%D` "
Today Date is: 12/06/19
durgasoft@durgasoft:~/scripts$ echo "Today Date is: $(date +%D) "
Today Date is: 12/06/19
```

Eg 2:

```
durgasoft@durgasoft:~/scripts$ echo "Number of files in Current Working Directory: `ls | wc -l` "
Number of files in Current Working Directory: 5
durgasoft@durgasoft:~/scripts$ echo "Number of files in Current Working Directory: $(ls | wc -l) "
Number of files in Current Working Directory: 5
```

Eg 3:

```
durgasoft@durgasoft:~/scripts$ echo "The No of Lines in test.sh: `cat test.sh | wc -l` "
The No of Lines in test.sh: 9
durgasoft@durgasoft:~/scripts$ echo "The No of Lines in test.sh: $(wc -l test.sh) "
The No of Lines in test.sh: 9 test.sh
```


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Eg 4:

```
durgasoft@durgasoft:~/scripts$ echo "My Current Working Directory: `pwd` "
My Current Working Directory: /home/durgasoft/scripts
durgasoft@durgasoft:~/scripts$ echo "My Current Working Directory: $(pwd) "
My Current Working Directory: /home/durgasoft/scripts
```

Topic-28: Command Line Arguments

The arguments which are passing from the command prompt at the time of executing our script, are called command line arguments.

$ ./test.sh learning linux is very easy

The command line arguments are learning, linux, is, very, easy.

Inside scritp we can access command line arguments as follows:

$# → Number of Arguments (5)
$0 → Script Name (./test.sh)
$1 → 1st Argument (learning)
$2 → 2nd Argument (linux)
$3 → 3rd Argument (is)
$4 → 4th Argument (very)
$5 → 5th Argument (easy)
$* → All Arguments (learning Linux is very easy)
$@ →All Arguments (learning Linux is very easy)
$? → Represents exit code of previously executed command or script.

Eg: test.sh

```
#! /bin/bash
echo "Number of arguments: $#"
echo "Script Name: $0"
echo "First argument: $1"
echo "Second argument: $2"
echo "Third argument: $3"
echo "Fourth argument: $4"
echo "Fifth argument: $5"
echo "Total arguments: $*"

durgasoft@durgasoft:~/scripts$ ./test.sh learning linux is very easy
Number of arguments: 5
Script Name: ./test.sh
First argument: learning
Second argument: linux
```


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```
Third argument: is
Fourth argument: very
Fifth argument: easy
Total arguments: learning linux is very easy
```

Difference between $@ and $*:

$@ → All command line arguments with space separator
"$1" "$2" "$3" ...
$* → All command line arguments as single string
"$1c$2c$3c.."
Where c is the first character of the Internal Field Separator (IFS).
The default first character is space.

How to Check Default IFS:

```
$ set | grep "IFS"
IFS=$' \t\n'
```

How to Change IFS:

```
#! /bin/bash

IFS="-"

echo "Number of arguments: $#"
echo "Script Name: $0"
echo "First argument: $1"
echo "Second argument: $2"
echo "Third argument: $3"
echo "Fourth argument: $4"
echo "Fifth argument: $5"
echo "Total arguments: $@"
echo "Total arguments: $*"

durgasoft@durgasoft:~/scripts$ test.sh learning unix is very easy
Number of arguments: 5
Script Name: /home/durgasoft/scripts/test.sh
First argument: learning
Second argument: unix
Third argument: is
Fourth argument: very
Fifth argument: easy
Total arguments: learning unix is very easy
Total arguments: learning-unix-is-very-easy
```


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Note: The main purpose of command line arguments is to customize behaviour of the script.

test.sh

```
#! /bin/bash
l=$(echo -n "DURGA"| wc -c)
echo "The Length of given String: $l"
```

This script will work only for string: DURGA

test.sh

```
#! /bin/bash
len=$(echo -n "$1"| wc -c)
echo "The Length of given string $1 : $len"
```

This script will work for any string provided from command prompt.

```
durgasoft@durgasoft:~/scripts$ test.sh
The Length of given string  : 0
durgasoft@durgasoft:~/scripts$ test.sh durgasoft
The Length of given durgasoft : 9
durgasoft@durgasoft:~/scripts$ test.sh  adsfkjshfdjkhsfkjhkjsfhk
The Length of given string adsfkjshfdjkhsfkjhkjsfhk : 24
```

Q1) Write Script to Create Log File with Timestamp

test.sh

```
#! /bin/bash
timestamp=$(date +%d_%m_%Y_%H_%M_%S)
echo "This is data to log file" >> ${timestamp}.log
echo "This is extra data to log file" >> ${timestamp}.log
date >> ${timestamp}.log
echo >> ${timestamp}.log
echo "Data Written to log file successfully"
```

If we execute this script, every time a new file will be created.
If we take
timestamp=$(date +%d_%m_%Y_%H_%M)
Then log file will be created for every new minute.

For every hour if want a new log file: timestamp=$(date +%d_%m_%Y_%H)
For every day if want a new log file: timestamp=$(date +%d_%m_%Y)

Topic-29: How to Read Dynamic Data from the User

By using read keyword we can read dynamic data from the end user.

Without Prompt Message:

```
durgasoft@durgasoft:~/scripts$ read a b
100 200
durgasoft@durgasoft:~/scripts$ echo "The values of a and b are:$a and $b"
The values of a and b are:100 and 200
```

With Prompt Message:

Approach-1

test.sh

```
#! /bin/bash
echo "Enter A Value:"
read A

echo "Enter B Value:"
read B

echo "A Value: $A"
echo "B Value: $B"
```

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter A Value:
100
Enter B Value:
200
A Value: 100
B Value: 200
```

test.sh

```
#! /bin/bash
echo -n "Enter A Value:"
read A
```

```
echo -n "Enter B Value:"
read B
echo "A Value: $A"
echo "B Value: $B"
durgasoft@durgasoft:~/scripts$ test.sh
Enter A Value:100
Enter B Value:200
A Value: 100
B Value: 200
```

Approach-2

```
#! /bin/bash
read -p "Enter A Value:" A
read -p "Enter B Value:" B

echo "A Value: $A"
echo "B Value: $B"

durgasoft@durgasoft:~/scripts$ test.sh
Enter A Value:100
Enter B Value:200
A Value: 100
B Value: 200

#! /bin/bash
read -p "Enter User Name:" user
read -p "Enter Password:" password

echo "$user thanks for your information"

durgasoft@durgasoft:~/scripts$ test.sh
Enter User Name:durga
Enter Password:anushka123
durga thanks for your information
```

Note:

```
read -p : Just to display prompt message
read -s : It hides input on screen which is provided by end user.

#! /bin/bash
read -p "Enter User Name:" user
read -s -p "Enter Password:" password
echo
echo "Hello $user , thanks for your information"
```

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter User Name:Durga
Enter Password:
Hello Durga , thanks for your information
```

Q2) Write a Script to Read Student Data and display to the Console for Confirmation?

```
#! /bin/bash
read -p "Enter Student Name:" name
read -p "Enter Student RollNo:" rollno
read -p "Enter Student Age:" age
read -p "Enter Student Marks:" marks
echo "Please confirm your details"
echo "-----------------------------------------------"
echo "Student Name: $name"
echo "Student Rollno: $rollno"
echo "Student Age: $age"
echo "Student Marks: $marks"

durgasoft@durgasoft:~/scripts$ test.sh
Enter Student Name:Durga
Enter Student RollNo:101
Enter Student Age:40
Enter Student Marks:89
Please confirm your details
-----------------------------------------------
Student Name: Durga
Student Rollno: 101
Student Age: 40
Student Marks: 89
```

Q3) Write a Script to Read Employee Details and Save to emp.txt File?

```
#! /bin/bash
read -p "Enter Employee Number:" eno
read -p "Enter Employee Name:" ename
read -p "Enter Employee Salary:" esal
read -p "Enter Employee Address:" eaddr

echo "Below details are saved to the file"
echo "$eno:$ename:$esal:$eaddr"
echo "$eno:$ename:$esal:$eaddr" >> emp.txt
```

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter Employee Number:100
Enter Employee Name:Sunny
Enter Employee Salary:1000
Enter Employee Address:Mumbai
Below details are saved to the file
100:Sunny:1000:Mumbai
durgasoft@durgasoft:~/scripts$ test.sh
Enter Employee Number:200
Enter Employee Name:Bunny
Enter Employee Salary:2000
Enter Employee Address:Hyderabad
Below details are saved to the file
200:Bunny:2000:Hyderabad
durgasoft@durgasoft:~/scripts$ test.sh
Enter Employee Number:300
Enter Employee Name:Chinny
Enter Employee Salary:3000
Enter Employee Address:Chennai
Below details are saved to the file
300:Chinny:3000:Chennai
durgasoft@durgasoft:~/scripts$
durgasoft@durgasoft:~/scripts$ cat emp.txt
100:Sunny:1000:Mumbai
200:Bunny:2000:Hyderabad
300:Chinny:3000:Chennai
```

emp.txt

```
durgasoft@durgasoft:~/scripts$ cat emp.txt
100:Sunny:1000:Mumbai
200:Bunny:2000:Hyderabad
300:Chinny:3000:Chennai
```

Q4) Write a Script that takes a String from the End User and Print its Length?

```
#! /bin/bash
read -p "Enter any string to find length:" str
len=$(echo -n $str | wc -c)
echo "Length of $str : $len"

durgasoft@durgasoft:~/scripts$ test.sh
Enter any string to find length:apple
Length of apple : 5
durgasoft@durgasoft:~/scripts$ test.sh
```

```
Enter any string to find length:durgasoftwaresolutions
Length of durgasoftwaresolutions : 22
```

Q5) Write a Script to Read File Name from the End User and display its Content?

```
#! /bin/bash

read -p "Enter any File name to display its content:" fname
echo "----------------------------------------------"
cat $fname
echo "----------------------------------------------"
durgasoft@durgasoft:~/scripts$ test.sh
Enter any File name to display its content:emp.txt
----------------------------------------------
100:Sunny:1000:Mumbai
200:Bunny:2000:Hyderabad
300:Chinny:3000:Chennai
----------------------------------------------
```

Q6) Write a Script to Read File Name from the End User and Remove Blank Lines Present in that File?

```
#! /bin/bash
read -p "Enter any File name to remove blank lines:" fname
grep -v "^$" $fname > temp.txt
mv temp.txt $fname
echo "In $fname all blank lines deleted"
```

Q7) Write a Script to Read File Name from the End User and Remove Duplicate Lines Present in that File?

```
#! /bin/bash
read -p "Enter any File name to remove duplicate lines:" fname

sort -u $fname > temp.txt
mv temp.txt $fname
echo "In $fname all duplicate lines deleted"
```

Topic-30: Operators

1) Arithmetic Operators

+ → Addition
- → Substraction
* → Multiplication (we should use * as it is wild card character)
/ → Division
% → Modulo Operator

Relational Operators: (Numeric Comparison Operators)

-gt →Greater than
-ge →Greater than or equal to
-lt →Less than
-le →Less than or equal to
-eq → Is equal to
-ne →Not equal to

These operators return boolean value (true/false)

Logical Operators:

-a → Logical AND
-o →Logical OR
! →Logical Not

Assignment operator =

Note: Except assignment operator, for all operators we have to provide space before and after operator.

How to perform Mathematical Operations:

There are multiple ways

1) By using expr keyword
2) By using let keyword
3) By using (())
4) By using []

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1) By using expr Keyword:

expr means expression and it is a keyword.

```
#! /bin/bash
read -p "Enter First Number:" a
read -p "Enter First Number:" b

sum=`expr $a + $b`
echo "The Sum: $sum"

sum=$(expr $a + $b)
echo "The Sum: $sum"
```

Note: While using expr keyword, $ symbol is mandatory.
Space must be required before and after + symbol.

2) By using let Keyword:

```
let sum=a+b
echo "The Sum: $sum"

let sum=$a+$b
echo "The Sum: $sum"
```

Here $ symbol is optional. But we should not provide space before and after +.

3) By using (()):

```
sum=$((a+b))
echo "The Sum: $sum"

sum=$(($a+$b))
echo "The Sum: $sum"
```

Here space and $ symbol, both are optional.

4) By using []:

```
sum=$[a+b]
echo "The Sum: $sum"

sum=$[$a+$b]
echo "The Sum: $sum"
```

Here also space and $ symbol, both are optional.

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Note: All the above 4 approaches will work only for integral arithmetic
(only for integer numbers).
If we want to perform floating point arithmetic then we should use bc command.

bc Command:

bc means binary calculator.
We can start binary calculator by using bc command.

```
durgasoft@durgasoft:~/scripts$ bc
bc 1.07.1
Copyright 1991-1994, 1997, 1998, 2000, 2004, 2006, 2008, 2012-2017 Free Software
Foundation, Inc.
This is free software with ABSOLUTELY NO WARRANTY.
For details type `warranty'.
10.5+30.6
41.1
10.2^2
104.0
10.5*3.6
37.8
ctrl+d → To exit bc
```

Note: bc can perform both integral and floating point arithmetic.

Script for floating Point Arithmetic:

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b

sum=$( echo $a+$b | bc)
echo "The Sum:$sum"

echo "The Difference: $( echo $a-$b | bc)"
echo "The Product: $( echo $a*$b | bc)"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter First Number:10.5
Enter Second Number:5.3
The Sum:15.8
The Difference: 5.2
The Product: 55.6
```

Q1) Write a Script to Read 2 Integer Numbers and Print Sum?

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b
sum=$[a+b]
echo "The Sum:$sum"
```

Q2) Write a Script to Read 4 Digit Integer Number and Print the Sum of Digits Present in that Number?

```
#! /bin/bash

read -p "Enter Any 4-digit Integer Number:" n

a=$( echo $n | cut -c 1)
b=$( echo $n | cut -c 2)
c=$( echo $n | cut -c 3)
d=$( echo $n | cut -c 4)

echo "The Sum of 4 digits : $[a+b+c+d]"

durgasoft@durgasoft:~/scripts$ test.sh
Enter Any 4-digit Integer Number:1234
The Sum of 4 digits : 10
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any 4-digit Integer Number:3456
The Sum of 4 digits : 18
```

Q3) Write a Script to Read Employee Monthly Salary and Print his Bonus. The Bonus should be 25% of Annual Salary

```
#! /bin/bash

read -p "Enter Employee Monthly Salary:" salary

annual_salary=$[salary*12]
bonus=$[annual_salary*25/100]
echo "The Bonus:$bonus"

durgasoft@durgasoft:~/scripts$ test.sh
Enter Employee Monthly Salary:10000
The Bonus:30000
```


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Topic-31: Control Statements

1) if statement
2) case statement
3) while loop
4) for loop
5) until loop
6) break
7) continue
8) exit

1) if Statement:

There are 4 types of if statements

1) simple if
2) if-else
3) nested if
4) ladder if

1) simple if:

```
if [ condition ]
    then
      action
fi
```

If condition is true then only action will be executed.

Q1) WAS to Read Name from the End User and if Name is Sunny then Display some Special Message?

```
#! /bin/bash

read -p "Enter Your Name:" name

if [ $name = "sunny" ]
then
echo "Hello Sunny Very Good Evening"
fi
echo "How are you"

durgasoft@durgasoft:~/scripts$ test.sh
Enter Your Name:durga
```


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```
How are you
durgasoft@durgasoft:~/scripts$ test.sh
Enter Your Name:sunny
Hello Sunny Very Good Evening
How are you
```

Note:

x=10 → Assignment
x = 10 → Comparison

2) if -else:

```
if [ condition]
    then
        action if condition is true
    else
        action if condition is false
fi
```

3) Nested if:

```
if [ condition ]
    then
        .........
        .........
        if [ condition ]
            then
                    .........
                    .........
            else
                    ........
        fi
            .....
        else
            ......
fi
```

4) ladder -if:

```
if [condition]
then
    action-1
elif [ condition ]
then
    action-2
elif [ condition ]
then
   action-3
```


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```
else
   default action
fi
```

Q2) Write a Script to find Greater of 2 Numbers?

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b

if [ $a -gt $b ]
then
      echo "Greater Number is:$a"
else
      echo "Greater Number is:$b"
fi

durgasoft@durgasoft:~/scripts$ test.sh
Enter First Number:10
Enter Second Number:20
Greater Number is:20
durgasoft@durgasoft:~/scripts$ test.sh
Enter First Number:20
Enter Second Number:10
Greater Number is:20
durgasoft@durgasoft:~/scripts$ test.sh
Enter First Number:-10
Enter Second Number:-20
Greater Number is:-10
```

Q3) Write a Script to Check whether Numbers OR Equal OR Not. If the Numbers are not Equal then Print Greater Number?

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b

if [ $a -eq $b ]
then
   echo "Both Numbers are equal"
elif [ $a -gt $b ]
then
   echo "First Number is greater than Second Number"
else
   echo "First Number is less than Second Number"
fi
```

Q4) Write a Script to find Greater of 3 Numbers?

1st Way:

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b
read -p "Enter Third Number:" c

if [ $a -gt $b ]
then
   if [ $a -gt $c ]
   then
      echo "The Greater Number:$a"
   else
      echo "The Greater Number:$c"
   fi
elif [ $b -gt $c ]
then
    echo "The Greater Number:$b"
else
   echo "The Greater Number:$c"
fi
```

2nd Way:

```
#! /bin/bash

read -p "Enter First Number:" a
read -p "Enter Second Number:" b
read -p "Enter Third Number:" c

if [ $a -gt $b -a $a -gt $c ]
then
  echo "The Greater Number: $a"
elif [ $b -gt $c ]
then
  echo "The Greater Number: $b"
else
  echo "The Greater Number: $c"
fi
```

WAS to check whether student is pass or fail based on given 3 subjects marks.
In any subject if marks less than 35 then status is fail.

1st Way:

```
#! /bin/bash

read -p "Enter First Subject Marks:" a
read -p "Enter Second Subject Marks:" b
read -p "Enter Third Subject Marks:" c

if [ $a -lt 35 ]
then
   echo "Student Failed"
elif [ $b -lt 35 ]
then
   echo "Student Failed"
elif [ $c -lt 35 ]
then
   echo "Student Failed"
else
   echo "Result is Pass"
fi
```

2nd Way:

```
#! /bin/bash

read -p "Enter First Subject Marks:" a
read -p "Enter Second Subject Marks:" b
read -p "Enter Third Subject Marks:" c

if [ $a -ge 35 -a $b -ge 35 -a $c -ge 35 ]
then
  echo "Result is Pass"
else
  echo "Result is Fail"
fi
```

The Funniest Example with if-else

```
#! /bin/bash

read -p "Enter Your Favourite Brand:" brand

if [ $brand = "KF" ]
then
   echo "It is Childrens Brand"

elif [ $brand = "KO" ]
```

```
then
   echo "It is not that much Kick"

elif [ $brand = "RC" ]
then
  echo "It is too light"

elif [ $brand = "FO" ]
then
  echo "Buy One Get One FREE"
else
  echo "Other Brands are not recommended"
fi

durgasoft@durgasoft:~/scripts$ ./test.sh
Enter Your Favourite Brand:KF
It is Childrens Brand
durgasoft@durgasoft:~/scripts$ ./test.sh
Enter Your Favourite Brand:KO
It is not that much Kick
durgasoft@durgasoft:~/scripts$ ./test.sh
Enter Your Favourite Brand:RC
It is too light
durgasoft@durgasoft:~/scripts$ ./test.sh
Enter Your Favourite Brand:FO
Buy One Get One FREE
durgasoft@durgasoft:~/scripts$
durgasoft@durgasoft:~/scripts$ ./test.sh
Enter Your Favourite Brand:KALYANI
Other Brands are not recommended
```

Exit Codes/ Status Codes:

Every command and script return some value after execution, which indicates that whether it is successfully executed or not. This return value is called exit code or status code.

We can find exit code by using "$?".

```
zero       means command/script executed successfully.
non-zero   means command/scrit not executed successfully.

durgasoft@durgasoft:~/scripts$ echo "Hello Friends"
Hello Friends
durgasoft@durgasoft:~/scripts$ echo "$?"
0
```

```
durgasoft@durgasoft:~/scripts$ rm sdfjkslajfdksajfjdsakjfdksajfkd
rm: cannot remove 'sdfjkslajfdksajfjdsakjfdksajfkd': No such file or
directory
durgasoft@durgasoft:~/scripts$ echo "$?"
1
```

exit Command:

In the script to stop execution in the middle, we can use exit command.

Syntax:

exit status_code
The allowed values for status_code are 0 to 255.
256 → 0
257 → 1
258 → 2
259 → 3
....

Q5) Write a Script that takes 2 Integer Numbers as Command Line Arguments and Prints Sum

If Number of Arguments is not 2, then we have to get Message saying "You should provide only 2 Arguments"

If the Arguments are not Integer Numbers then we have to get Message saying "You should provide Integer Numbers only"

test.sh

```
#! /bin/bash

if [ $# -ne 2 ]
then
   echo "You Should provide exactly two arguments"
   exit 1
fi
x=$1
y=$2
sum=`expr $x + $y `
if [ $? -ne 0 ]
then
   echo "You should provide integer numbers only"
   exit 2
else
  echo "The Sum:$sum"
fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh 10 20
The Sum:30
durgasoft@durgasoft:~/scripts$ test.sh
You Should provide exactly two arguments
durgasoft@durgasoft:~/scripts$ test.sh 10
You Should provide exactly two arguments
durgasoft@durgasoft:~/scripts$ test.sh 10 20 30
You Should provide exactly two arguments
durgasoft@durgasoft:~/scripts$ test.sh 10 durga
expr: non-integer argument
You should provide integer numbers only
```

Q6) Write a Script that Reads an Integer Number and Check whether the given Number is +ve Number OR -ve Number?

```
#! /bin/bash

read -p "Enter integer number to check:" n
if [ $n  -gt 0 ]; then
     echo "$n is +ve number"
else
      echo "$n is -ve number"
fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:10
10 is +ve number
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:-10
-10 is -ve number
```

Note: If we want to take then in the same line then we should use ;

```
if [ $n  -gt 0 ]; then
```

The advantage is we can reduce the number of lines.

Q7) Write a Script that Reads an Integer Number and Checks whether it is Even Number OR not?

```
#! /bin/bash

read -p "Enter integer number to check:" n
if [ $[n%2]  -eq 0 ]; then
     echo "$n is even number"
```

```
else
    echo "$n is odd number"
 fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:10
10 is even number
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:15
15 is odd number
```

Q8) Write a Script that Reads an Integer Number and Checks whether it is 3 Digit Number OR not?

```
#! /bin/bash

read -p "Enter integer number to check:" n

if [ $n -ge 100 -a $n -le 999 ]; then
    echo "$n is 3-dgit number"
else
    echo "$n is not 3-digit number"
fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:123
123 is 3-dgit number
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:45
45 is not 3-digit number
durgasoft@durgasoft:~/scripts$ test.sh
Enter integer number to check:1234
1234 is not 3-digit number
```

File Test Options:

-e → Returns true if file/directory exists
-s → Returns true if the file is non-empty
-f → Returns true if the file is a regular file
-d → Returns true if the file is a directory
-l → Returns true if the file is link file
-b → Returns true if the file is block special file
-c → Returns true if the file is character special file

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-r → Returns true if current user has read permission on the file
-w → Returns true if current user has write permission on the file
-x → Returns true if current user has execute permission on the file
-o → Returns true if current user is owner of the file.
file1 -ot file2 → Returns true if file1 is older than file2 (last modified time)
file1 -nt file2 → Returns true if file1 is newer than file2(last modified time)

Eg 1: Script to Test whether the given File Exists OR not?

```
#! /bin/bash

read -p "Enter File Name to test:" fname

if [ -e $fname ]
then
  echo "$fname exists"
else
  echo "$fname not exists"
fi
```

Eg 2: Script to Test whether the given File is Regular File OR Directory?

```
#! /bin/bash

read -p "Enter File Name to test:" fname

if [ -e $fname ]; then
   if [ -f $fname ]; then
        echo "It is regular file"
   elif [ -d $fname ]; then
        echo "It is Directory file"
   else
        echo "It is special file"
   fi
else
   echo "$fname does not exist"
fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to test:a.txt
It is regular file
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to test:dir1
It is Directory file
```

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to test:dddddd
dddddd does not exist
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to test:/bin
It is Directory file
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to test:/dev/vcsa3
It is special file
```

Write a Script that Reads a File Name and Display its Content to the Terminal?

```
#! /bin/bash

read -p "Enter File Name to test:" fname

if [ -e $fname ]; then
   if [ -f $fname ]; then
        if [ -r $fname ]; then
             cat $fname
        else
           echo "User not having Read permission"
        fi
   else
        echo "It is not a regular file"
   fi
else
   echo "$fname does not exist"
fi
```

Q9) Write a Script that Reads File Name and Check whether it is Empty File OR not?

```
#! /bin/bash

read -p "Enter File Name to test:" fname

if [ -e $fname ]; then
     if [ -f $fname ]; then
          if [ -s $fname ]; then
                echo "$fname is not empty file"
          else
                echo "$fname is empty file"
          fi
```

```
        else
           echo "It is not a regular file"
        fi
    else
        echo "$fname does not exist"
    fi
```

Q10) Write a Script that Accepts 2 File Names and Check whether both Files having same Content OR not?

```
#! /bin/bash

read -p "Enter First File Name: " fname1
read -p "Enter Second File Name: " fname2

result=$(cmp $fname1 $fname2)
if [ -z "$result" ]; then
      echo "The given 2 files having same content"
else
      echo "The given 2 files having different content"
fi
```

Note:

-z is string comparison option.
returns True if the string is empty.

Q11) Write a Script that Accepts a File Name and Display User Permissions?

```
#! /bin/bash

read -p "Enter First File Name: " fname

READ=NO
WRITE=NO
EXECUTE=NO

if [ -r $fname ]; then
    READ=YES
fi

if [ -w $fname ]; then
     WRITE=YES
fi
```


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```
if [ -x $fname ]; then
      EXECUTE=YES
fi

echo "User Permissions Summary"
echo "------------------------"
echo "Read Permission: $READ"
echo "Write Permission: $WRITE"
echo "Execute Permission: $EXECUTE"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter First File Name: a.txt
```

User Permissions Summary

```
Read Permission: YES
Write Permission: YES
Execute Permission: NO
```

Q12) Write a Scirpt that Reads File Name and Remove the specified File?

```
#! /bin/bash

read -p "Enter file/directory name to delete:" fname
if [ -e $fname ]; then
      rm -r $fname
      echo "$fname removed successfully"
else
       echo "$fname does not exist"
fi
```

Mini Application:

Copy all files and directories present in the first directory to the second directory. We should create compressed tar file and have to move that tar file.
After moving tar file to the second directory, extract all files and directories and remove that tar file.

```
copy  /home/durgasoft/x   /home/durgasoft/y
```

Tests to Perform:

1) The number of command line arguments should be 2
2) The source and destination directories should be available already
3) The source and destination arguments should be directories
4) The user should has read and execute permissions on source directory
5) The user should has write and execute permissions on destination directory
6) All error messages should be send to error file and the file name should contain timestamp.
7) All intermediate steps should be displayed to the terminal.

String Test Options:

1) str1 = str2 → Returns true if both strings are same
2) str1 != str2 → Returns true if both strings are different
3) -z str → Returns true if the string is empty
4) -n str → Returns true if the string is not empty
5) str1 > str2 → Returns true if the str1 is alphabetically greater than str2
5) str1 < str2 → Returns true if the str1 is alphabetically less than str2

Demo Program For String Comparison:

```
#! /bin/bash

read -p "Enter First String:" str1
read -p "Enter Second String:" str2

if [ $str1 = $str2 ]; then
  echo "Both strings are equal"

elif [ $str1 \< $str2 ]; then
  echo "$str1 is less than $str2"
else
  echo "$str1 is greater than $str2"
fi
```

Note:

elif [$str1 \< $str2]; then

If we are not using \ symbol then < acts as input redirection operator. To consider < as symbol only we should use \.

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter First String:Durga
Enter Second String:Durga
Both strings are equal
durgasoft@durgasoft:~/scripts$ test.sh
```

```
Enter First String:Apple
Enter Second String:Banana
Apple is less than Banana
durgasoft@durgasoft:~/scripts$ test.sh
Enter First String:Banana
Enter Second String:Apple
Banana is greater than Apple
```

Q13) Write a Script that Checks whether Login User is Root OR not. If Login User is Root then Display 1st 5 Current Running Processes Information

```
#! /bin/bash

user=$(whoami)

if [ $user != "root" ]; then
   echo "Current user not root user and hence exiting"
   exit 1
fi

echo "The Five Current Running Processes information"
echo "=============================================="
ps -ef | head -5
```

```
durgasoft@durgasoft:~/scripts$ test.sh
Current user not root user and hence exiting
durgasoft@durgasoft:~/scripts$ sudo -i
[sudo] password for durgasoft:
root@durgasoft:~# whoami
root
root@durgasoft:~# test.sh
test.sh: command not found
root@durgasoft:~# pwd
/root
root@durgasoft:~# /home/durgasoft/scripts/test.sh
```

The 5 Current Running Processes Information

```
UID        PID  PPID  C STIME TTY          TIME CMD
root         1     0  0 19:32 ?        00:00:03 /sbin/init splash
root         2     0  0 19:32 ?        00:00:00 [kthreadd]
root         3     2  0 19:32 ?        00:00:00 [rcu_gp]
root         4     2  0 19:32 ?        00:00:00 [rcu_par_gp]
```

Q14) Write a Script to Test whether the given String is Empty OR not? If it is not Empty then Print its Length

```
#! /bin/bash

read -p "Enter Any String to test:"  str

if [ -z $str ]; then
     echo "Provided input string is empty string"
else
      echo "Provided input string is not empty string"
      echo "Its length is : $( echo -n $str | wc -c)"
fi
```

2) case Statement:

- If multiple options are available then it is not recommended to use nested if-else statements. It increases length of the code and reduces readability.

- To handle such type of requirements we should go for case statement.

Syntax:

```
case $variable in

 option1 )
            action-1
            ;;
 option2 )
            action-2
            ;;
 option3 )
            action-3
           ;;
 * )
           default action
           ;;
 esac
```

Note:

1) space is optional while defining options.
2) ;; can be used to come out of case statement.
3) ;; is mandatory for all options except for default option.
4) If we take default option at the beginning, then for any input the same default option will be executed.

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Eg 1: Write a script to read a number from 0 to 9 and print equivalent English word?

```
#! /bin/bash

read -p "Enter Any digit from 0 to 9:"  n

case $n in
  0)  echo "ZERO"
      ;;
  1)  echo "ONE"
      ;;
  2)  echo "TWO"
      ;;
  3)  echo "THREE"
      ;;
  4)  echo "FOUR"
      ;;
  5)  echo "FIVE"
      ;;
  6)  echo "SIX"
      ;;
  7)  echo "SEVEN"
      ;;
  8)  echo "EIGHT"
      ;;
  9)  echo "NINE"
      ;;
  *)  echo "Please enter a digit from 0 to 9 only"
      esac
```

Q15) Write a Script that Reads Favourite Brand and Prints corresponding Meaningful Message?

```
#! /bin/bash

read -p "Enter Your Favourite Brand: " brand

case $brand in
"KF")
        echo "It is childrens brand"
        ;;
"KO")
         echo "It is not that much kick"
         ;;
```


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```
"RC")
        echo "It is too light"
        ;;
"FO")
        echo "Buy one get one FREE"
        ;;
*)
        echo "Other brands are not recommended"
esac
```

Q16) Write a Script that Accepts a Single Character and Check whether the given Character is Alphabet OR Digit OR Special Character?

```
#! /bin/bash

read -p "Enter Any Character to check: " ch

case $ch in
        [a-zA-Z])
              echo "It is an Alphabet symbol"
              ;;
        [0-9])
              echo "It is a Digit"
              ;;
        [^a-zA-Z0-9])
               echo "It is a Special Symbol"
               ;;
        *)
             echo "Enter only one character"
        esac

durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: a
It is an Alphabet symbol
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: 8
It is a Digit
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: $
It is a Special Symbol
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: durga
Enter only one character
```


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Q17) Write a Script that Accepts a Single Character and Checks whether it is Digit OR Special Character OR Vowel OR Consonent?

```
#! /bin/bash

read -p "Enter Any Character to check: " ch

case $ch in
   [^a-zA-Z0-9])
      echo "It is a Special Character"
      ;;
   [0-9])
      echo "It is a Digit"
      ;;
   [aeiouAEIOU])
      echo "It is a Vowel"
         ;;
   [^aeiouAEIOU])
      echo "It is a Consonent"
         ;;
   *)
       echo "Enter only one character"
esac

durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: a
It is a Vowel
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: s
It is a Consonent
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: 7
It is a Digit
durgasoft@durgasoft:~/scripts$ test.sh
Enter Any Character to check: $
It is a Special Character
```

Q18) Write a Script that performs File Operations based on provided Option?

A → Display Content
B → Append Content
C → Overwrite Content
D → Delete Content

The file name is abc.txt

```
#! /bin/bash
echo "A → Display Content"
echo "B → Append Content"
echo "C → Overwrite Content"
echo "D → Delete Content"
read -p "Choose Your Option A|B|C|D: " option

case $option in
   A)
      if [ ! -s "abc.txt" ]; then
         echo "It is an empty file"
      else

                  echo "The content of the file is:"
                  echo "--------------------------"
                  cat abc.txt
      fi
      ;;
   B)
      read -p "Provide your data to append:" data
      echo $data >> abc.txt
      echo "Data Appended"
      ;;
   C)
      read -p "Provide your data to overwrite:" data
      echo $data > abc.txt
      echo "Old data Overwritten with new data "
      ;;
   D)
      cat /dev/null > abc.txt
      echo "Deleted the content of the file"
         ;;
   *)
       echo "Choose only A|B|C|D. Execute Again"
esac
```

Q19) Write a Script that Reads 2 Integer Numbers and perform required Mathematical Operation based on provided Option?

1 → Addition Operation
2 → Subtraction Operation
3 → Multiplication Operation
4 → Division Operation

```
#! /bin/bash

read -p "Enter First Number: " n1
read -p "Enter Second Number: " n2
echo ""
echo "1 --> Addition Operation"
echo "2 --> Subtraction Operation"
echo "3 --> Multiplication Operation"
echo "4 --> Division Operation"
read -p "Choose Your Option 1|2|3|4: " option

case $option in
   1)
      echo "$n1 + $n2 = $((n1+n2))"
      ;;
   2)
      echo "$n1 - $n2 = $((n1-n2))"
      ;;
   3)
      echo "$n1 * $n2 = $((n1*n2))"
      ;;
   4)
      echo "$n1 / $n2 = $((n1/n2))"
      ;;
   *)
       echo "Choose only 1|2|3|4. Execute Again"
esac
```

Iterative Statements:

If we want to execute a group of commands multiple times then we should go for iterative statements.

There are 3 types of iterative statements

1) **while loop**
2) **until loop**
3) **for loop**

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1) while Loop:

If we don't know the number of iterations in advance, then we should go for while loop.

Syntax:

```
while [ condition ]
do
   body
done
```

As long as condition is true, then body will be executed. Once condition fails then only loop will be terminated.

Q1) Write a Script to Print Numbers from 1 to 10

```
#! /bin/bash

i=1

while [ $i -le 10 ]
do
      echo $i
       let i++
done
```

Q2) Write a Script to generate Numbers until Limit which is provided by End User?

```
#! /bin/bash

read -p "Enter Limit:" n
i=1

while [ $i -le $n ]
do
     echo $i
     sleep 2
     let i++
done
```

Note: If we don't want to perform any operation for a particular amount of time (i.e just pausing is required) then we should go for sleep command. The argument to the sleep command is seconds.

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Eg:

```
sleep 2
sleep 3
sleep 0.5
```

Q3) Write a Script to find the Sum of First n Integers, where n is provided by End User?

```
#! /bin/bash

read -p "Enter n value:" n

i=1
sum=0
while [ $i -le $n ]
do
  let sum=sum+i
  let i++
done

echo "The Sum of first $n numbers: $sum"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter n value:3
The Sum of first 3 numbers: 6
durgasoft@durgasoft:~/scripts$ test.sh
Enter n value:10
The Sum of first 10 numbers: 55
durgasoft@durgasoft:~/scripts$ test.sh
Enter n value:12345
The Sum of first 12345 numbers: 76205685
```

Q4) Write a Script to Display Timer (Digital Timer)?

```
#! /bin/bash

while [ true ]
do
   clear
   printf "\n\n\n\n\n\n\t\t\t\t$(date +%H:%M:%S)"
   sleep 1
done
```

Note: To use escape characters like \n and \t, we should not use echo and we should use printf command.

Note: true and false are keywords which represents boolean values.

break Statement:

Based on some condition, if we want to break loop execution (i.e to come out of loop) then we should go for break statement.

Eg 1:

```
#! /bin/bash

i=1

while [ $i -le 10 ]
do
  if [ $i -eq 5 ]; then
    break
  fi
  echo $i
  let i++
done
```

Output:

```
1
2
3
4
```

Eg 2:

```
#! /bin/bash

while [ true ]
do
   clear
   printf "\n\n\n\n\n\n\t\t\t\t$(date +%H:%M:%S)"
   sleep 1
   h=$(date +%H)
   m=$(date +%M)
   if [ $h -eq 20  -a $m -eq 35 ]; then
      break
   fi
done
```

continue Statement:

We can use continue statement to skip current iteration and continue for the next iteration.

Eg:

```
#! /bin/bash

i=0

while [ $i -lt 10 ]
do
  let i++
  if [ $[i%2] -eq 0 ]; then
    continue
  fi
  echo $i
done
```

Output:

```
1
3
5
7
9
```

Write a Script to Read File Name and Display its Content?

```
#! /bin/bash

while [ true ]
do
    read -p "Enter File Name to Display content: " fname

    # Checking whether the file exists or not and whether regular file or not
    if [ -f $fname ]; then
        echo "The content of $fname :"
        echo "----------------------"
        cat $fname
    else
        echo "$fname does not exist"
    fi

    read -p "Do you want to display content of another file [Yes|No]:" option
    case $option in
      [yY]|[Yy][eE][sS])
```

```
            continue
            ;;
      [nN]|[nN][oO])
            break
            ;;
   esac
done
echo "Thanks for using application"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter File Name to Display content: abc.txt
```

The content of abc.txt:

```
Java
Python
Do you want to display content of another file [Yes|No]:y
Enter File Name to Display content: a.txt
```

The content of a.txt:

```
Tue Dec 10 17:00:48 IST 2019
Do you want to display content of another file [Yes|No]:YES
Enter File Name to Display content: b.txt
```

The content of b.txt:

```
December 2019
Su Mo Tu We Th Fr Sa
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31

Do you want to display content of another file [Yes|No]:Y
Enter File Name to Display content: durga.txt
durga.txt does not exist
Do you want to display content of another file [Yes|No]:N
Thanks for using application
```

Write a Script that Reads a String as Input and find its Reverse?
Write a Script that performs Reverse of given String?

```
#! /bin/bash

read -p "Enter any string to find reverse: " str

len=$( echo -n $str | wc -c )
output=""

while [ $len -gt 0 ]
do
   ch=$( echo -n $str | cut -c $len)
   output=$output$ch
   let len--
done
echo "The Original String: $str"
echo "The Reversed String: $output"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Enter any string to find reverse: durga
The Original String: durga
The Reversed String: agrud
durgasoft@durgasoft:~/scripts$ test.sh
Enter any string to find reverse: abc
The Original String: abc
The Reversed String: cba
durgasoft@durgasoft:~/scripts$ test.sh
Enter any string to find reverse: durgasoft
The Original String: durgasoft
The Reversed String: tfosagrud
durgasoft@durgasoft:~/scripts$
```

Eg:

```
#! /bin/bash

while [ true ]
do
  clear
  tput cup 7 25
  echo "WELCOME TO DURGASOFT"
  sleep 2
  clear
  tput cup 7 25
```

```
  echo "UNIX/LINUX CLASSES"
  sleep 2
done
```

Note: tput cup 7 25
It moves the cursor position to 7th row and 25th column.

Q5) Write a Script to Read Employee Data and Insert into emp.txt File?

```
#! /bin/bash

while [ true ]
do
   read -p "Employee Number: " eno
   read -p "Employee Name: " ename
   read -p "Employee Salary: " esal
   read -p "Employee Address: " eaddr
   echo "$eno:$ename:$esal:$eaddr" >> emp.txt
   echo "Employee Record Inserted Successfully"
   read -p "Do you want to insert one more record [Yes|No]: " option
   case $option in
      [yY]|[Yy][eE][sS])
            continue
            ;;
      [nN]|[nN][oO])
            break
            ;;
    esac
done
echo "Open emp.txt to see all employees information"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Employee Number: 100
Employee Name: Sunny
Employee Salary: 1000
Employee Address: Hyderabad
Employee Record Inserted Successfully
Do you want to insert one more record [Yes|No]: y
Employee Number: 200
Employee Name: Bunny
Employee Salary: 2000
Employee Address: Mumbai
Employee Record Inserted Successfully
```


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```
Do you want to insert one more record [Yes|No]: Yes
Employee Number: 300
Employee Name: Chinny
Employee Salary: 3000
Employee Address: Hyderabad
Employee Record Inserted Successfully
Do you want to insert one more record [Yes|No]: YES
Employee Number: 400
Employee Name: Vinny
Employee Salary: 4000
Employee Address: Chennai
Employee Record Inserted Successfully
Do you want to insert one more record [Yes|No]: N
Open emp.txt to see all employees information
```

Q6) Write a Script to implement cat Command with -n Option?

```
durgasoft@durgasoft:~/scripts$ cat -n emp.txt
    1   100:Sunny:1000:Hyderabad
    2   200:Bunny:2000:Mumbai
    3   300:Chinny:3000:Hyderabad
    4   400:Vinny:4000:Chennai
```

Syntax -1: To read data from the file by using while loop

```
cat emp.txt |
while read line
do
  do something with that line
done
```

Syntax -2: To read data from the file by using while loop

```
while read line
do
    do something with that line
done < emp.txt
```

test.sh

```
#! /bin/bash

fname=$1
if [ ! -f $fname ]; then
  echo "Please provide already existing regular file only"
  exit 1
fi
```

```
count=1
while read line
do
    echo "     $count  $line"
    let count++
done < $fname
```

Output

```
durgasoft@durgasoft:~/scripts$ test.sh emp.txt
    1  100:Sunny:1000:Hyderabad
    2  200:Bunny:2000:Mumbai
    3  300:Chinny:3000:Hyderabad
    4  400:Vinny:4000:Chennai
durgasoft@durgasoft:~/scripts$ test.sh abcd.txt
Please provide already existing regular file only
```

2) until Loop:

It is opposite to while loop.

Syntax:

```
until [ condition ]
do
  body
done
```

The body will be executed as long as condition returns false. Once condition returns true, then loop will be terminated.

Q7) Write a Script to Print 1 to 5 by using until Loop?

```
#! /bin/bash
i=1
until [ $i -gt 5 ]
do
   echo $i
   let i++
done
```

```
durgasoft@durgasoft:~/scripts$ test.sh
1
2
3
4
5
```


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3) for Loop:

If we want to perform some action for every item in the given list, then we should go for for loop. It is similar to Java's for-each loop.

Syntax:

```
for variable in item1 item2 item3... itemN
do
  action
done
```

Eg 1: To print numbers from 1 to 5.

```
#! /bin/bash

for i in 1 2 3 4 5
do
   echo "Current Number: $i"
done
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Current Number: 1
Current Number: 2
Current Number: 3
Current Number: 4
Current Number: 5
```

Eg 2:

```
#! /bin/bash

for course in java unix python testing datascience
do
   echo "Course Name: $course"
done
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Course Name: java
Course Name: unix
Course Name: python
Course Name: testing
Course Name: datascience
```

Q8) Write a Script that Display Numbers from 1 to 100, which are divisible by 10.

```
#! /bin/bash

count=0
for num in {1..100}
do
  if [ $[ num%10 ] -eq 0 ]; then
    echo "$num"
    let count++
  fi
done
echo "The number of values: $count"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
10
20
30
40
50
60
70
80
90
100
The number of values: 10
```

Q9) Write a Script to Display all File Names Present in Current Working Directory?

```
#! /bin/bash

for name in *
do
   if [ -f $name ]; then
      echo $name
   fi
done
```

Q10) Write a Script to append Current Date and Time, Current Month Calander in every .txt File Present in Current Working Directory?

```
#! /bin/bash

for fname in *.txt
do
   date >> $fname
   cal >> $fname
done
echo "Task Completed"
```

Q11) Write a Script that Print all Command Line Arguments?

```
#! /bin/bash

if [  $# -ne 0 ]; then

        count=1
        for arg in $@
        do
           echo "Command Line Argument - $count: $arg"
           let count++
        done
else
      echo "Command line arguments are not passed"
fi
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Command line arguments are not passed
durgasoft@durgasoft:~/scripts$ test.sh 10 20 30 40
Command Line Argument - 1: 10
Command Line Argument - 2: 20
Command Line Argument - 3: 30
Command Line Argument - 4: 40
durgasoft@durgasoft:~/scripts$ test.sh learning linux is very easy
Command Line Argument - 1: learning
Command Line Argument - 2: linux
Command Line Argument - 3: is
Command Line Argument - 4: very
Command Line Argument - 5: easy
```

Case Study:

emp.txt:

```
100:sunny:1000:Hyderabad
200:bunny:2000:Chennai
300:chinny:3000:Hyderabad
400:vinny:4000:Delhi
500:pinny:5000:Hyderabad
```

1) Write a Script to Display all Employees Information where Salary is Greater than 2500

```
#! /bin/bash
for record in $(cat emp.txt)
do
    sal=$(echo $record | cut -d ":" -f 3)
    if [ $sal -gt 2500 ]; then
        echo $record
    fi
done
```

2) Write a Script to Save all Employees Information where Salary is Greater than 2500 and City is Hyderabad to hyd.txt

```
#! /bin/bash

for record in $(cat emp.txt)
do
  sal=$(echo $record | cut -d ":" -f 3)
  city=$(echo $record | cut -d ":" -f 4)
  if [ $sal -gt 2500 -a $city = "Hyderabad" ]; then
    echo $record >> hyd.txt
  fi
done
echo "Task Completed"
```

3) Write a Script to Display Minimum and Maximum Salaries?

```
#! /bin/bash
max=$(cat emp.txt | head -1 | cut -d ":" -f 3)
min=$(cat emp.txt | head -1 | cut -d ":" -f 3)
max_record=$(cat emp.txt | head -1)
min_record=$(cat emp.txt | head -1)
for record in $(cat emp.txt)
do
  sal=$(echo $record | cut -d ":" -f 3)
```

```
  if [ $sal -gt $max ]; then
    max=$sal
    max_record=$record
  fi
  if [ $sal -lt $min ]; then
    min=$sal
    min_record=$record
  fi
done
echo "The Maximum Salary:$max"
echo "The Maximum Salaried Employeed Information:"
echo "Employee No:$(echo $max_record | cut -d ":" -f 1)"
echo "Employee Name:$(echo $max_record | cut -d ":" -f 2)"
echo "Employee Salary:$(echo $max_record | cut -d ":" -f 3)"
echo "Employee Address:$(echo $max_record | cut -d ":" -f 4)"
echo
echo "The Minimum Salary:$min"
echo "The Minimum Salaried Employeed Information:"
echo "Employee No:$(echo $min_record | cut -d ":" -f 1)"
echo "Employee Name:$(echo $min_record | cut -d ":" -f 2)"
echo "Employee Salary:$(echo $min_record | cut -d ":" -f 3)"
echo "Employee Address:$(echo $min_record | cut -d ":" -f 4)"
```

Q12) Write a Script to Display Multiple Files Content to the Terminal and all File Names passed as Command Line Arguments?

```
#! /bin/bash

if [ $# -ne 0 ]; then
        for fname in $@
        do
          if [ -f $fname ]; then
            echo "$fname content:"
            echo "======================"
            cat $fname
          else
            echo "$fname does not exist or it is not a regular file"
          fi
        done
else
  echo "Please pass atleast one file name"
fi
```

Q13) Write a Script to append Multiple Files Content to a Single File result.txt. File Names are passed as Command Line Arguments?

```
#! /bin/bash

if [ $# -ne 0 ]; then
        for fname in $@
        do
          if [ -f $fname ]; then
            cat $fname >> result.txt
          else
            echo "$fname does not exist or it is not a regular file"
          fi
        done
else
  echo "Please pass atleast one file name"
fi
```

Alternative Syntax of for Loop (Advanced for Loop):

Old Style of for Loop:

```
for variable in item1 item2 ... itemN
do
  body
done
```

Advanced for Loop:

```
for ((i=1; i<10; i++))
do
  body
done
```

Q14) Write a Script to Print Numbers from 0 to 4 by using advanced for Loop?

```
#! /bin/bash
for ((i=0;i<5;i++))
do
  echo $i
done
```

Output:

```
0
1
2
3
4
```

Q15) Write a Script to Print Numbers for Count Down from provided Number to 1 by using advanced for Loop?

```
#! /bin/bash
read -p "Enter n value:" n
for((i=n,i>=1;i--)
do
  echo $i
  sleep 1.5
done
```

Q16) Write a Script to Display n^{th} Table?

```
#! /bin/bash
read -p "Enter n value:" n
for ((i=1; i<=10; i++))
do
  echo "$n * $i = $[n*i]"
done
```

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter n value:9
9 * 1 = 9
9 * 2 = 18
9 * 3 = 27
9 * 4 = 36
9 * 5 = 45
9 * 6 = 54
9 * 7 = 63
9 * 8 = 72
9 * 9 = 81
9 * 10 = 90
```

Q17) Write a Script to generate Hotel Bill based on Customer selected Items. The Items and Price Information is as follows

A → Vadapov (Each Plate Rs 30 /-)
B → Dosa (Each Plate Rs 50 /-)
C → Poori (Each Plate Rs 40 /-)
D → Idli (Each Plate Rs 25 /-)

```
#! /bin/bash
echo "Welcome to DURGA HOTEL"
echo
amount=0
while [ true ]
do
 echo "Menu Items:"
 echo "....................."
 echo "A --->Vadapov (Each Plate Rs 30 /-)"
 echo "B --->Dosa (Each Plate Rs 50 /-)"
 echo "C --->Poori (Each Plate Rs 40 /-)"
 echo "D --->Idli (Each Plate Rs 25 /-)"
 read -p "Choose Your Required Item A|B|C|D:" item
 case $item in
   A)
    read -p "Enter the number of plates of Vadapov, you required:" quantity
    amount=$[amount+quantity*30]
    ;;
   B)
    read -p "Enter the number of plates of Dosa, you required:" quantity
    amount=$[amount+quantity*50]
    ;;
   C)
    read -p "Enter the number of plates of Poori, you required:" quantity
    amount=$[amount+quantity*40]
    ;;
   D)
    read -p "Enter the number of plates of Idli, you required:" quantity
    amount=$[amount+quantity*25]
    ;;
   *)
    echo "You entered invalid option. Choose Again"
    continue
  esac
  read -p "Do you want to order any other item[Yes|No]:" option
  case $option in
```

```
        [Yy]|[Yy][Ee][Ss])
                continue
                        ;;
        [Nn]|[Nn][Oo])
                break
                        ;;
  esac
done
echo
echo "Your Total Bill Amount: Rs $amount/-"
echo "Thanks for visiting DURGA HOTEL"

durga@durga-VirtualBox:~/scripts$ test.sh
Welcome to DURGA HOTEL

Menu Items:
……….……
A → Vadapov (Each Plate Rs 30 /-)
B → Dosa (Each Plate Rs 50 /-)
C → Poori (Each Plate Rs 40 /-)
D → Idli (Each Plate Rs 25 /-)
Choose Your Required Item A|B|C|D:D
Enter the number of plates of Idli, you required:4
Do you want to order any other item[Yes|No]:yes

Menu Items:
……….……
A → Vadapov (Each Plate Rs 30 /-)
B → Dosa (Each Plate Rs 50 /-)
C → Poori (Each Plate Rs 40 /-)
D → Idli (Each Plate Rs 25 /-)
Choose Your Required Item A|B|C|D:C
Enter the number of plates of Poori, you required:3
Do you want to order any other item[Yes|No]:Yes

Menu Items:
……….……
A → Vadapov (Each Plate Rs 30 /-)
B → Dosa (Each Plate Rs 50 /-)
C → Poori (Each Plate Rs 40 /-)
D → Idli (Each Plate Rs 25 /-)
Choose Your Required Item A|B|C|D:B
Enter the number of plates of Dosa, you required:2
Do you want to order any other item[Yes|No]:Yes
```

Menu Items:

……..
A → Vadapov (Each Plate Rs 30 /-)
B → Dosa (Each Plate Rs 50 /-)
C → Poori (Each Plate Rs 40 /-)
D → Idli (Each Plate Rs 25 /-)
Choose Your Required Item A|B|C|D:A
Enter the number of plates of Vadapov, you required:1
Do you want to order any other item[Yes|No]:No

Your Total Bill Amount: Rs 350/-
Thanks for visiting DURGA HOTEL

Q18) Write a Script to Test whether the given Number is Prime Number OR not?

If any number has two factors (1 and itself), such type of number is said to be prime number.

2 → 1, 2
3 → 1, 3
5 → 1, 5

```
#! /bin/bash
read -p "Enter Any Number to test whether it is prime or not:" n

if [ $n -le 1 ]; then
  echo "$n is not a PRIME number"
  exit 1
fi

for ((i=2;i<=n/2;i++))
do
 if [ $[n%i] -eq 0 ]; then
   echo "$n is not PRIME number"
   exit 1
 fi
done
echo "$n is a PRIME number"
```

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is prime or not:23
23 is PRIME number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is prime or not:29
29 is PRIME number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is prime or not:35
35 is not PRIME number
```

Topic-32: Arrays

If we want to represent a group of values with a single name then we should go for arrays concept.

How to Create Arrays:

1. If we know elements at the beginning:
courses=(Java Python Linux Django)

2. If we don't know elements at the biginning:
courses[0]=Java
courses[1]=Python
courses[2]=Linux
courses[3]=Django

The index values need not be consecutive.We can take randomly.

courses[10]=DataScience
courses[20]=Devops

How to Access Elements:

We can access array elements by using index which is zero based.i.e the index of first element is zero.

${courses[0]} → First element
${courses[1]} → Second element
${courses[@]}→ All elements present inside array.
${courses[*]} → All elements present inside array into a single string separated by first character in IFS(Internal Field Separator)
${!courses[@]}→ It returns all indexes where elements are available.
${#courses[@]}→ It returns the number of elements present inside array.
${#courses[0]} → It returns the length of first element.

Demo Script:

```
#! /bin/bash
courses[0]=Java
courses[1]=Python
courses[2]=Linux
courses[3]=Django
courses[10]=DataScience
```


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```
courses[20]=Devops
echo "First Element : ${courses[0]}"
echo "Second Element : ${courses[1]}"
echo "All Elements with @ : ${courses[@]}"
echo "All elements with * : ${courses[*]}"
echo "The indices where elements are available : ${!courses[@]}"
echo "The total number of elements : ${#courses[@]}"
echo "The length of first element : ${#courses[0]}"
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
First Element : Java
Second Element : Python
All Elements with @ : Java Python Linux Django DataScience Devops
All elements with * : Java Python Linux Django DataScience Devops
The indices where elements are available : 0 1 2 3 10 20
The total number of elements : 6
The length of first element : 4
```

Q1) Write a Script to Create an Array with some Elements and Print all Elements by using while Loop, for Loop and advanced for Loop?

```
#! /bin/bash

declare -a fruits
fruits=("Apple" "Orange" "Banana" "Mango")
size=${#fruits[@]}
i=0

echo "All elements by using while loop:"
while [ $i -lt $size ]
do
  echo ${fruits[$i]}
  let i++
done

echo "All elements by using for loop:"
for fruit in ${fruits[@]}
do
   echo $fruit
done

echo "All elements by using advanced for loop:"
for (( i=0; i < ${#fruits[@]}; i++ ))
```

```
do
  echo ${fruits[$i]}
done
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
All elements by using while loop:
Apple
Orange
Banana
Mango
All elements by using for loop:
Apple
Orange
Banana
Mango
All elements by using advanced for loop:
Apple
Orange
Banana
Mango
```

Note:

1) If we create an array with elements directly
   fruits=("Apple" "Orange" "Banana" "Mango")
   then the indices will be 0,1,2,3 etc

2) After creating array we can add extra elements also
   fruits=("Apple" "Orange" "Banana" "Mango")
   fruits[4]="Sapota"

Q2) Write a Script for accessing Array Elements by using for Loop if Indices are Random?

```
#! /bin/bash
declare -a fruits
fruits[10]="Apple"
fruits[20]="Banana"
fruits[30]="Orange"
fruits[40]="Mango"

echo "Accessing based on Values:"
for fruit in ${fruits[@]}
do
```

```
 echo $fruit
done
echo
echo "Accessing based on Index:"
for index in ${!fruits[@]}
do
 echo ${fruits[$index]}
done
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
Accessing based on Values:
Apple
Banana
Orange
Mango

Accessing based on Index:
Apple
Banana
Orange
Mango
```

Q3) Is it Possible to Remove Array Elements?

Yes possible by using unset command.

Eg:

```
#! /bin/bash
declare -a fruits
fruits[10]="Apple"
fruits[20]="Banana"
fruits[30]="Orange"
fruits[40]="Mango"

echo "All Array Elements Before Removal: ${fruits[@]}"
unset fruits[20]
unset fruits[40]
echo "All Array Elements After Removal: ${fruits[@]}"
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
All Array Elements Before Removal: Apple Banana Orange Mango
All Array Elements After Removal: Apple Orange
```

Q4) Write a Script to Store given n Numbers in to an Array?

```
#! /bin/bash
read -p "Enter The Number Of values:" n

for ((i=0,j=1;i<n;i++))
do
  read -p "Enter The Number-$[j++]:" NUM[${i}]
done
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter The Number Of values:3
Enter The Number-1:10
Enter The Number-2:20
Enter The Number-3:30
```

Q5) Write a Script to Read n Numbers and Store inside Array. Print the Sum of Even Numbers and Odd Numbers separately?

```
#! /bin/bash
read -p "Enter Number of Values:" n

for((i=0,j=1;i<n;i++))
do
  read -p "Enter The Number-$[j++]:" NUM[$i]
done

esum=0
osum=0
for val in ${NUM[@]}
do
  if [ $[val%2] -eq 0 ]; then
    let esum=esum+val
  else
    let osum=osum+val
  fi
done
echo "The Sum of Even Numbers: $esum"
echo "The Sum of Odd Numbers: $osum"
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Number of Values:5
Enter The Number-1:10
Enter The Number-2:12
Enter The Number-3:13
Enter The Number-4:15
Enter The Number-5:20
The Sum of Even Numbers: 42
The Sum of Odd Numbers: 28
```

Q6) Write a Script to Store all .txt File Names Present in Current Working Directory in to an Array and Print Permissions of every File

```
#! /bin/bash
files=($(ls *.txt))
for fname in ${files[@]}
do
  echo -ne "$fname:\t"
  if [ -r $fname ]; then
    echo -ne "READ(Y)\t"
  else
    echo -ne "READ(N)\t"
  fi
  if [ -w $fname ]; then
    echo -ne "WRITE(Y)\t"
  else
    echo -ne "WRITE(N)\t"
  fi
  if [ -x $fname ]; then
    echo  "EXECUTE(Y)"
  else
    echo  "EXECUTE(N)"
  fi
done
```

Output:

```
durga@durga-VirtualBox:~/scripts$ test.sh
abcd.txt:       READ(Y)       WRITE(Y)      EXECUTE(N)
abc.txt:        READ(Y)       WRITE(Y)      EXECUTE(N)
a.txt:          READ(Y)       WRITE(Y)      EXECUTE(N)
b.txt:          READ(Y)       WRITE(Y)      EXECUTE(N)
c.txt:          READ(Y)       WRITE(Y)      EXECUTE(N)
emp.txt:        READ(Y)       WRITE(Y)      EXECUTE(N)
hyd.txt:        READ(Y)       WRITE(Y)      EXECUTE(N)
output.txt:     READ(Y)       WRITE(Y)      EXECUTE(N)
result.txt:     READ(Y)       WRITE(Y)      EXECUTE(N)
z.txt:          READ(N)       WRITE(N)      EXECUTE(N)
```

Topic-33: Shell Script Functions

If any group of commands are repeatedly required, then it is not recommended to write these commands separately everytime. It increases length of the code and reduces readability.

Such type of repeated code we have to define inside a block and we can call that block where ever required. This block of commands is nothing but function.

Hence function is nothing but a block of repeatable commands.

Advantages of Functions:

1) **It reduces length of the code.**
2) **It improves readability.**
3) **It improves maintainability.**
4) **It promotes DRY principle.**
   DRY → Don't Repeat Yourself.

How to define a Function?

1st Way:

```
function function_name()
{
   commands
}
```

2nd Way:

```
function_name()
{
   commands
}
```


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How to call a Function:

function_name param1 param2 param3 ...

Q1) Write a Function to Display wish Message?

```
#! /bin/bash

#defining a function
wish()
{
    echo "Hello Friends... Good Evening"
}

wish # calling a function
wish
wish
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Hello Friends... Good Evening
Hello Friends... Good Evening
Hello Friends... Good Evening
```

Note: Before calling a function, it should be defined.

Eg 2:

```
#! /bin/bash

f1()
{
  echo "I am in f1 function"
}
f2()
{
  echo "I am in f2 function"
  f1
}
f1
f2
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
I am in f1 function
I am in f2 function
I am in f1 function
```

Function with Parameters:

Function can accept parameters also. With in the function we can access parameters as follows:

$1 → First Parameter
$2 → Second Parameter
$@ → All Paramters
$* → All parameters
$# → Total number of parameters
$0 → It is script name but not function name

Q2) Write a Function to demonstrate how to access Function Parameters?

```
#! /bin/bash
function demo()
{
  echo "First Parameter: $1"
  echo "Second Parameter: $2"
  echo "Third Parameter: $3"
  echo "Total Number of Paramerters: $#"
  echo "All Parameters with @: $@"
  echo "All Parameters with *: $*"
  echo "Script Name:$0"
}

demo 10 20 30 40 50
```

Output:

```
First Parameter: 10
Second Parameter: 20
Third Parameter: 30
Total Number of Paramerters: 5
All Parameters with @: 10 20 30 40 50
All Parameters with *: 10 20 30 40 50
Script Name:/home/durga/scripts/test.sh
```


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Eg:

```
#! /bin/bash

wish()
{
  if [ $# -eq 0 ]; then
    echo "Hello Guest Good Evening"
  else
    echo "Hello $1 Good Evening"
  fi
}
wish
wish Durga
wish Sunny
```

Output:

```
durgasoft@durgasoft:~/scripts$ test.sh
Hello Guest Good Evening
Hello Durga Good Evening
Hello Sunny Good Evening
```

Q3) Write a Function that takes 2 Integer Numbers as Parameters and perform Arithmetic Operations

```
#! /bin/bash
calc()
{
if [ $# -ne 2 ]; then
echo "You should pass exactly 2 arguments"
else
a=$1
b=$2
echo "$a+$b = $((a+b))"
echo "$a-$b = $((a-b))"
echo "$a*$b = $((a*b))"
echo "$a/$b = $((a/b))"
echo
fi
}
calc 10
calc 20 10
calc 200 100
calc 2000 1000
```

Output:

```
You should pass exactly 2 arguments
20+10 = 30
20-10 = 10
20*10 = 200
20/10 = 2

200+100 = 300
200-100 = 100
200*100 = 20000
200/100 = 2

2000+1000 = 3000
2000-1000 = 1000
2000*1000 = 2000000
2000/1000 = 2
```

Q4) Write a Function to Print all Parameters?

```
#! /bin/bash
parameter_printing()
{
  if [ $# -eq 0 ]; then
    echo "No parameters passed to this function"
  else
    echo "All Passed Parameters are:"
    echo "......................."
    for p in $@
    do
        echo $p
    done
  fi
}
parameter_printing
parameter_printing  A B C D E
```

Output: No parameters passed to this function

All Passed Parameters are:

```
A
B
C
D
E
```


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Q5) Write a Function to find Maximum of 2 given Integer Numbers?

```
#! /bin/bash
max()
{
  if [ $1 -gt $2 ]; then
    echo "The Maximum of $1 and $2 :$1"
  else
    echo "The Maximum of $1 and $2: $2"
  fi
}
max 10 20
max 200 100
```

Output:

```
The Maximum of 10 and 20: 20
The Maximum of 200 and 100 :200
```

Q6) Write a Function to find Maximum of 3 given Integer Numbers?

```
#! /bin/bash
max()
{
  a=$1
  b=$2
  c=$3
  if [ $a -gt $b -a $a -gt $c  ]; then
    echo "Biggest Number:$a"
  elif [ $b -gt $c ]; then
    echo "Biggest Number:$b"
  else
    echo "Biggest Number:$c"
   fi
}
read -p "Enter First Number:" n1
read -p "Enter Second Number:" n2
read -p "Enter Third Number:" n3
max  $n1 $n2 $n3
```


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Q7) Write a Function to compare the given 2 Integers?

```
#! /bin/bash
compare()
{
  if [ $1 -eq $2 ]; then
    echo "Both Numbers are equal"
  elif [ $1 -gt $2 ]; then
    echo "$1 is greater than $2"
  else
    echo "$1 is less than $2"
  fi
}
compare 10 10
compare 10 20
compare 200 100
```

Output:

```
Both Numbers are equal
10 is less than 20
200 is greater than 100
```

Q8) Write a Function to find Factorial of a given Integer Number?

```
#! /bin/bash
factorial()
{
  original=$n
  fact=1
  while [ $n -gt 1 ]
  do
    let fact=fact*n
    let n--
  done
  echo "The Factorial of $original is: $fact"
}
read -p "Enter a number to find factorial:" n
factorial $n
}

#! /bin/bash
factorial()
```

```
{
  original=$1
  x=$1
  fact=1
  while [ $x -gt 1 ]
  do
    let fact=fact*x
    let x--
  done
  echo "The Factorial of $original is: $fact"
}
read -p "Enter a number to find factorial:" n
factorial $n
}
```

Q9) Write a Function to find Factorial of 1st 10 Natural Numbers?

```
#! /bin/bash
factorial()
{
 original=$1
 n=$1
 fact=1
 while [ $n -gt 1 ]
 do
  let fact=fact*n
  let n--
 done
 echo "The Factorial of $original: $fact"
}
for i in {1..10}
do
 factorial $i
done

durga@durga-VirtualBox:~/scripts$ test.sh
The Factorial of 1: 1
The Factorial of 2: 2
The Factorial of 3: 6
The Factorial of 4: 24
The Factorial of 5: 120
The Factorial of 6: 720
The Factorial of 7: 5040
```

```
The Factorial of 8: 40320
The Factorial of 9: 362880
The Factorial of 10: 3628800
```

Q10) Write a Function to Check whether the given Number is Even Number OR not?

```
#! /bin/bash
even_odd()
{
  n=$1
  if [ $[n%2] -eq 0 ]; then
     echo "$n is an Even Number"
  else
     echo "$n is an Odd Number"
  fi
}

read -p "Enter Any Number to test whether it is Even or Odd:" n
even_odd  $n
```

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is Even or Odd:10
10 is an Even Number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is Even or Odd:13
13 is an Odd Number
```

Q11) Write a Function to Test whether the given Number is Positive OR Negative Number?

```
#! /bin/bash
positive_negative()
{
   n=$1
   if [ $n -gt 0 ]; then
      echo "$n is a Positive Number"
   elif [ $n -lt 0 ]; then
      echo "$n is a Negative Number"
   else
      echo "It is just Zero"
   fi
}
read -p "Enter Any number to test whether it is positive or negative:" n
```

```
positive_negative  $n

durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any number to test whether it is positive or negative:10
10 is a Positive Number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any number to test whether it is positive or negative:-20
-20 is a Negative Number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any number to test whether it is positive or negative:0
It is just Zero
```

Prime Numbers:

Any positive number greater than 1, which has no other factors except 1 and the number itself, is called prime number.

Eg: 2, 3, 5, 7, 11, 13 etc

Any Positive Number which has more than 2 factors, such type of numbers are called Composite Numbers.

Eg: 4, 6, 8, 12 etc

1 is neither prime nor composite. It is a unique number.

Q12) Write a Function to Check whether the given Number is Prime Number OR not?

```
#! /bin/bash
prime_check()
{
  n=$1
  if [ $n -le 1 ]; then
    echo "$n is not a PRIME number"
  else
    is_prime="yes"
    for ((i=2;i<n;i++))
    do
     if [ $[n%i] -eq 0 ]; then
          echo "$n is not a PRIME Number"
          is_prime="no"
          break
        fi
```

```
    done
    if [ $is_prime = "yes" ]; then
      echo "$n is a PRIME Number"
    fi
   fi
}
read -p "Enter Any Number to test whether it is PRIME or not:" n
prime_check $n

durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is PRIME or not:129
129 is not a PRIME Number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is PRIME or not:127
127 is a PRIME Number
durga@durga-VirtualBox:~/scripts$ test.sh
Enter Any Number to test whether it is PRIME or not:19
19 is a PRIME Number
durga@durga-VirtualBox:~/script
```

Q13) Write a Function to generate Prime Numbers which are Less than OR Equal to given Number?

```
#! /bin/bash
prime_numbers_generator()
{
  n=$1
  for((n1=2;n1<=n;n1++))  //Repeat from 2 to n every number to test
  do
    is_prime="yes"
    for((i=2;i<n1;i++)) //To test current number n1 is prime or not
    do
      if [ $[n1%i] -eq 0 ]; then
        is_prime="no"
            break
      fi
    done
    if [ $is_prime = yes ]; then
      echo $n1
    fi
  done
 }
read -p "Enter N value:" n
prime_numbers_generator $n
```

```
durga@durga-VirtualBox:~/scripts$ test.sh
Enter N value:20
2
3
5
7
11
13
17
19
```

Q14) Write a Function to generate 1st n Prime Numbers?

```
#! /bin/bash
prime_numbers_generator()
{
 n=$1
 count=0
 for((n1=2;n1>=2;n1++)) # n1=2,3,4,5,6,7,8,....
 do
  is_prime=yes
  for((i=2;i<n1;i++))
  do
   if [ $[n1%i] -eq 0 ]; then
     is_prime=no
        break
   fi
  done
  if [ $is_prime = yes ]; then
    echo $n1
    let count++
  fi
  if [ $count -eq $n ]; then
    break
  fi
 done
}
read -p "Enter n value:" n
prime_numbers_generator $n

durga@durga-VirtualBox:~/scripts$ test.sh
Enter n value:1
2
durga@durga-VirtualBox:~/scripts$ test.sh
```

```
Enter n value:2
2
3
durga@durga-VirtualBox:~/scripts$ test.sh
Enter n value:5
2
3
5
7
11
```

Variable Scope:

Bydefault every variable in shell script is global. i.e we can access anywhere in our script. But before using a variable, it should be declared already.

Eg 1:

```
#! /bin/bash
f1()
{
  echo "x value : $x"
}
x=10
f1
```

Output: x value : 10

Eg 2:

```
#! /bin/bash
f1()
{
  x=20
  echo "x value : $x"
}
x=10
f1
echo "After f1 execution x value: $x"
```

Output:

```
x value : 20
After f1 execution x value: 20
```

Eg 3:

```
#! /bin/bash
f1()
{
   echo "x value : $x"
}
f1
x=10
f1
```

Output:

```
x value :
x value : 10
```

The variables which are declared inside a function, can be accessed outside of that function, because every variable has global scope by default.

Eg 4:

```
#! /bin/bash
f1()
{
   x=10
}
f1
echo "x value : $x"
```

Output: x value : 10

If we want a variable only within the function and should not be available outside of that function, then we have to use local keyword for the variable.
local variables can be accessed only inside function and cannot be accessed outside of that function.

Eg:

```
#! /bin/bash
f1()
{
   local x=10
   echo "Inside function x value: $x"
}
f1
echo "outside function x value : $x"
```

Ouput:

Inside function x value: 10
outside function x value :

Return Statement in Functions:

Every function in shell scripting returns some value. The default returned value is the exit code of the last command inside function.
But based on our requirement we can return values explicitly by using return statement.

return <exitcode>
The allowed values for exitcode are 0 to 255.
0 means successful
non-zero means unsuccessful.

We can get return value of function by using $?.

Eg:

```
#! /bin/bash
sum()
{
   if [ $# != 2 ]; then
     echo "You should pass exactly two numbers"
     return 1
   else
     echo "The SUM:$(($1+$2))"
   fi
}
sum 10 20
echo "The Return value of this function:$?"
echo
sum 10
echo "The Return value of this function:$?"
```

```
durgasoft@durgasoft:~/scripts$ test.sh
The SUM:30
The Return value of this function:0

You should pass exactly two numbers
The Return value of this function:1
```


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Use Case:

```
backup()
{
   commands to take backup
}
backup
if [ $? != 0 ]; then
  something goes wrong backup failed
else
  backup successful
fi
```

break vs exit vs return:

1) break:

We can use break only inside loops to break loop exeuction.we will come out of the loop and remaining statements after loop will be executed.

2) exit:

We can use anywhere exit statement to terminate script execution.The script will be terminated. No chance of executing any other statement.

3) return:

We can use return statement only inside function to stop function execution. After return statement, the remaining statements inside function won't be exeuction. But after function call the remaining statements will be executed.

How to Call Functions Present in another Script:

util.sh

```
#! /bin/bash
x=888
y=999
add()
{
  echo "$1 + $2 = $[$1+$2]"
}
multiply()
{
  echo "$1 * $2 = $[$1*$2]"
}
subtract()
```

```
{
  echo "$1 - $2 = $[$1-$2]"
}
divide()
{
  echo "$1 / $2 = $[$1/$2]"
}
```

test.sh

```
#! /bin/bash
.  ./util.sh #This is just inclusion and we are not executing util.sh
add 10 20
subtract 20 10
multiply 10 20
divide 20 10
echo "The value of x:$x"
echo "The value of y:$y"

durga@durga-VirtualBox:~/scripts$ test.sh
10 + 20 = 30
20 - 10 = 10
10 * 20 = 200
20 / 10 = 2
The value of x:888
The value of y:999
```