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Exercise 1

Basic Commands

Question

Show GNU/Linux commands to do the following

1. Print the current working directory
2. Print the home directory of the current user
3. Print current GNU/Linux distribution
4. Print current Linux Kernel version
5. Print current user name
6. Print all the running processes
7. Print disk usage statistics in human readable form
8. Print process with maximum CPU usage

Script/Output

```
$ pwd
/home/nasc

$ echo $HOME
/home/nasc

$ lsb_release -d
Description:  Linux Mint 21.1

$ uname -r
5.15.0-70-generic

$ echo $USER
nasc

$ echo $whoami
nasc

$ ps -e

$ df -h

$top -o +%CPU
```

Exercise 2

Commands for Understanding File System Organisation

Question

Show GNU/Linux commands to do the following

1. Create a directory by the name `UnixLab`
2. Create three files - `file1.txt`, `file2.txt`, `file3.txt` inside `UnixLab` directory
3. Create a new directory named `Code` inside `UnixLab` and copy the three files to it
4. Remove `file1.txt`, `file2.txt`, `file3.txt` inside `UnixLab` directory
5. List the contents of `Code` directory
6. Create directory in a given path (Assume some sub directories specified in the path does not exist).
7. Count the number of directories in a given directory
8. Print only the directories in a given directory
9. Show attributes of all files in a directory

```
$ mkdir UnixLab

$ cd UnixLab/
$ touch file1.txt file2.txt file3.txt

$ mkdir Code
$ cp file1.txt file2.txt file3.txt Code/

$ rm file1.txt file2.txt file3.txt

$ cd Code
$ ls
file1.txt  file2.txt  file3.txt

$ mkdir /home/nasc/unix/trial -p

$ find /home/nasc/unix/ -mindepth 1 -type d | wc -l
1

$ $ find /home/nasc/unix/ -type d
/home/nasc/unix/
/home/nasc/unix/trial

$ ls -l
```

Exercise 3

File Operations

Question

Show GNU/Linux commands to do the following

1. Store first fifteen lines of the file `/usr/share/dict/words` to the file `dictionary.txt` in the user's home directory
2. Print the line number of the string `India` in the file `/usr/share/dict/words`
3. Given a file with a number of lines, show the lines with "the" in it.
4. Given a set of words, order them in lexicographic order using filter.
5. Compare two files containing words

```
$ head -n 15 /usr/share/dict/words > ~/dictionary.txt

$ grep -n "^India$" /usr/share/dict/words
8882:India

$ grep "\<the\>" aboutnasc.txt

$ sort
zebra
apple
cat
apple
cat
zebra

$ diff names.txt names2.txt
2,4c2
< cat
< dance
< dog
---
> camera
```

Exercise 4

File Permission and Ownership

Question

Create a group called `ksd` and add two members (`alan` and `tim`) to it. Create a folder `/home/projectA` and change ownership to group `ksd`. Verify that both users in the `ksd` group have read and write access to the folder. Create another group `teachers` and add a user `charles` to it. Verify if the folder `/home/projectA` is accessible by `charles`.

```
# groupadd ksd
# useradd -G ksd alan
# useradd -G ksd tim
# passwd alan
New password:
Retype new password:
passwd: password updated successfully
passwd tim
New password:
Retype new password:
passwd: password updated successfully
# mkdir /home/projectA

# ls -l /home/
total 12
drwxr-xr-x 52 nasc      nasc      4096 May  7 16:22 nasc
drwxr-xr-x  2 root      root      4096 May  7 18:34 projectA

# chown :ksd /home/projectA/
# ls -l /home/
total 12
drwxr-xr-x 52 nasc      nasc      4096 May  7 16:22 nasc
drwxr-xr-x  2 root      ksd       4096 May  7 18:34 projectA

# chmod g+w /home/projectA/
# chmod o-rx projectA
# ls -l /home/
total 12
drwxr-xr-x 52 nasc      nasc      4096 May  7 16:22 nasc
drwxrwx---  2 root      ksd       4096 May  7 18:34 projectA

# exit
logout

$ su alan
Password:
$ whoami
alan
$ cd /home/projectA
$ touch hello.txt
$ ls
hello.txt
$ ls -l
total 0
-rw-rw-r-- 1 alan alan 0 May  7 18:39 hello.txt
$ chown :ksd hello.txt
$ ls -l
total 0
```

```
-rw-rw-r-- 1 alan ksd 0 May  7 18:39 hello.txt
$ exit
$ su tim
Password:
$ cd /home/projectA
$ echo "hello" > hello.txt
$ nano hello.txt
$ cat hello.txt
hello
$ exit
$ sudo su
[sudo] password for nasc:
# groupadd teacher
useradd -G teacher charles
passwd charles
New password:
Retype new password:
passwd: password updated successfully
# exit
exit
$ su charles
Password:
$ cd /home/projectA
sh: 1: cd: can't cd to /home/projectA
```

Exercise 5

Calculator

Question

Write a shell script to implement a menu driven calculator. Following operations should be implemented

1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Modulus

```
echo "Calculator"
echo "**********"
echo "1. Addition"
echo "2. Subtraction"
echo "3. Multiplication"
echo "4. Division"
echo "5. Modulus"

echo "Enter your choice: "
read choice

echo "Enter first number: "
read num1
echo "Enter second number: "
read num2

# Invoke the appropriate function based on user choice
case $choice in
  1) ((result=$num1 + $num2))
     echo "Result: $result";;
  2) ((result=$num1 - $num2))
     echo "Result: $result";;
  3) ((result=$num1 * $num2))
     echo "Result: $result";;
  4) ((result=$num1 / $num2))
     echo "Result: $result";;
  5) ((result=$num1 % $num2))
     echo "Result: $result";;
  *)  echo "Invalid choice";;
esac
```

Exercise 6

Printing Natural Numbers

Question

Write a shell script to display odd natural numbers from 1 to 99 using while and for loop.

```
echo "Using for loop"
for (( i=1; i<100; i+=2 ))
do
  echo -n "$i "
done

echo
echo
echo "Using while loop"
i=1
while ((i<=99))
do
  echo -n "$i "
  ((i+=2))
done
echo
```

Exercise 7

Largest Number

Question

Print the largest among the given three numbers.

```
echo "Enter three numbers: "
read num1 num2 num3

if ((num1>num2 && num1>num3))
then
  echo "Largest number is $num1"
elif ((num2>num1 && num2>num3))
then
  echo "Largest number is $num2"
else
  echo "Largest number is $num3"
fi
```

Exercise 8

System Configuration

Question

Write a shell script to show various system configurations like Home directory, current shell, Operating system information, Kernel information, current working directory, PATH variable contents.

```
echo "Home directory: $HOME"
echo
echo "Current shell: $SHELL"
echo
echo "Operating system: $(uname -a)"
echo
echo "Kernel: $(uname -r)"
echo
echo "Current working directory: $PWD"
echo
echo "PATH variable contents: $PATH"
```

Exercise 9

Sorting

Question

Given n numbers, sort them in ascending order.

```
if (($# < 2))
then
  echo "Enter at least 2 numbers"
  exit 1
fi

sorted_numbers=($(echo $* | tr ' ' '\n' | sort -n))

echo "Sorted numbers: ${sorted_numbers[@]}"
```

Exercise 10

Finding Top Scorer in a Class using Awk

Question

Write an awk program which reads an input file containing marks in 3 subjects of students in a class and display the top scorer in the class.

Program

```
BEGIN
{
  max_score = 0
  top_scorer = ""
  FS = ","
}

{
  total_marks = $2+$3+$4

  student_name = $1

  if (total_marks > max_score)
  {
    max_score = total_marks
    top_scorer = student_name
  }
}

END
{
  print "Top Scorer: " top_scorer, "\nTotal Marks: " total_marks
}
```

Input File

```
  Abc,25,30,45
  Pqr,30,20,45
  Xyz,40,40,30
```

Output

```
$awk -f topscore.awk marks.txt
Top Scorer: Xyz
Total Marks: 110
```

Exercise 11

Listing Players from a Country

Question

Write an AWK program to read an input file containing 3 fields: Name of the player, Country, and Total Runs Scored. Display the names of players from India. Also, print the total runs scored by Indian players.

Program

```
BEGIN{
  FS = ","
  total_score=0
  print "Indian Players are\n"
}
$2 == "INDIA"{
  print $1
  total_score += $3
}
END {
  print "\nTotal Score by Indians: " total_score
}
```

Input File

```
  SR Tendulkar,INDIA,15921
  RT Ponting,Australia,13378
  JH Kallis,South Africa,13289
  R Dravid,INDIA,13288
  AN Cook,England,12472
  KC Sangakkara,Srilanka,12400
  BC Lara,West Indies,11953
  S Chanderpaul,West Indies,11867
  DPMD Jayawardene,Srilanka,11814
  JE Root,England,11196
  SM Gavaskar,INDIA,10122
```

Output

```
  Indian Players are

  SR Tendulkar
  R Dravid
  SM Gavaskar

  Total Score by Indians: 39331
```

Exercise 12

Finding Average Marks of Students in a Programme using Regular Expression

Question

Write an AWK program that reads an input file with 3 fields: Register No., Name, and Marks. Register No. is a combination of a 2-letter college code, 2 digits for the year, a 4-letter programme code, and a 2-digit number (e.g., NA20PICS07, NA19CMSR15, NM21CSTR15). Write a program to find the average marks of students in the Computer Science programme (Code: ’PICS’) at a college with the code ’NA’. Use regular expression.

Program

```
BEGIN{
  FS = ","
  total_marks=0
}
$1 ~ /^NA[0-9]{2}(PICS)[0-9]{2}$/ {
  marks = $3
  total_marks += marks
  count++
}
END{
  average = total_marks / count
  print "Average Marks: " average
}
```

Input File

```
NA20PICS01,Abc,202
NA20PICS02,Pqr,150
NA20CMSR01,Wer,110
NA20CSTR01,Tyu,200
NA20PICS03,Xyz,220
NA20CPHR07,Jkl,240
NA20AECR01,Pkl,260
NA20AECR02,Avt,280
NA20AHIT03,Dm,201
```

Output

```
Average Marks: 190.667
```