PERI
INSTITUTE OF TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ACADEMIC YEAR: 2023-2024

LAB MANUAL

CS3461- OPERATING SYSTEMS LABORATORY

(IV SEMESTER)

REGULATION 2021

PERI Institute of Technology

Department of Computer Science and Engineering

VISION AND MISSION OF THE INSTITUTION

Vision:

PERI Institute of Technology visualizes growing in future to an internationally recognized seat of higher learning in engineering, technology & science. It also visualizes being a research incubator for academicians, industrialists and researchers from across the world, enabling them to work in an environment with the sophisticated and state of the art equipment and amenities provided at the institute.

Mission:

In the process of realization of its Vision, PERIIT strives to provide quality technical education at affordable cost in a challenging & stimulating environment with state-of-the-art facilities and a global team of dedicated and talented academicians, without compromising in its core values of honesty, transparency and excellence.

VISSION AND MISSION OF THE DEPARTMENT

Vision:

The vision of the department is to prepare industry-ready competent professionals with moral values by imparting scientific knowledge and skill-based education.

Mission:

- To provide exposure of latest tools and technologies in the broad area of computing.
- To promoter search-based projects/activities in the emerging area soft technology.
- ToenhanceIndustryInstituteInteractionprogramtogetacquaintedwithcorporate cultureand to develop entrepreneurship skills.
- To induce ethical values and spirit of social commitment.

SYLLABUS

1. Installation of Operating system : Windows/ Linux

2. Illustrate UNIX commands and Shell Programming

3. Process Management using System Calls : Fork, Exec, Getpid, Exit, Wait, Close

4. Write C programs to implement the various CPU Scheduling Algorithms

5. Illustrate the inter process communication strategy

6. Implement mutual exclusion by Semaphores

7. Write a C program to avoid Deadlock using Banker's Algorithm

8. Write a C program to Implement Deadlock Detection Algorithm

9. Write C program to implement Threading

10. Implement the paging Technique using C program

11. Write C programs to implement the following Memory Allocation Methods

 a. First Fit b. Worst Fit c. Best Fit

12. Write C programs to implement the various Page Replacement Algorithms

13. Write C programs to Implement the various File Organization Techniques

14. Implement the following File Allocation Strategies using C programs

    - Sequential b. Indexed c. Linked

15. Write C programs for the implementation of various disk scheduling algorithms

16. Install any guest operating system like Linux using VMware

LIST OF EXPERIMENTS

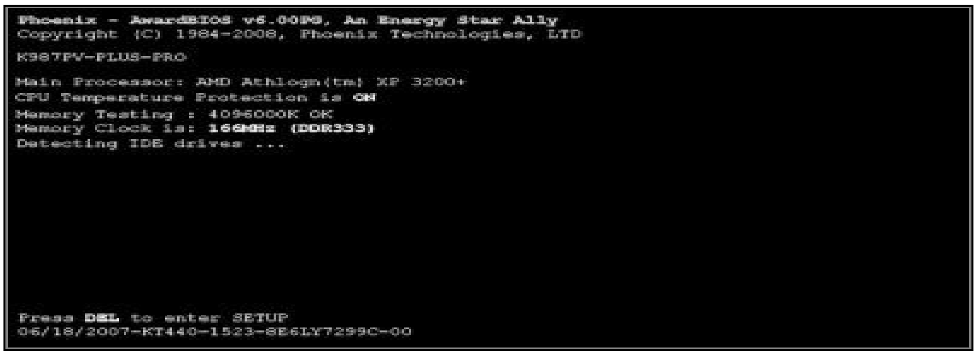
Ex.No:1 **Installation of Linux Operating System**

Aim:

To study the installation of Linux operating system.

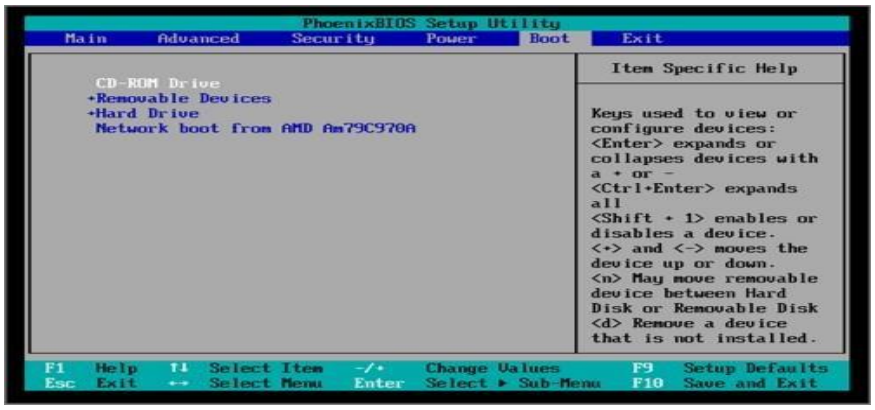
Procedure:

1. **Back Up Your Existing Data!**
This is highly recommended that you should take backup of your entire data before start with the installation process.
2. **Obtaining System Installation Media**
Download latest Desktop version of Ubuntu from this link: http://www.ubuntu.com/download/desktop
3. **Booting the Installation System**
There are several ways to boot the installation system. Some of the very popular ways are , Booting from a CD ROM, Booting from a USB memory stick, and Booting from TFTP.
Here we will learn how to boot installation system using a CD ROM.
Before booting the installation system, one need to change the boot order and set CD-ROM as first boot device.
4. **Changing the Boot Order of a Computers**
As your computer starts, press the DEL, ESC, F1, F2, F8 or F10 during the initial startup screen. Depending on the BIOS manufacturer, a menu may appear. However, consult the hardware documentation for the exact key strokes. In my machine, its DEL key as shown in following screen- shot.



```
Phoenix - AwardBIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2008, Phoenix Technologies, LTD

K987PV-PLUS-PRO

Main Processor: AMD Athlogn(tm) XP 3200+
CPU Temperature Protection is ON
Memory Testing : 4096000K OK
Memory Clock is: 166MHz (DDR333)
Detecting IDE drives ...


Press DEL to enter SETUP
06/18/2007-KT440-1523-8E6LY7299C-00
```

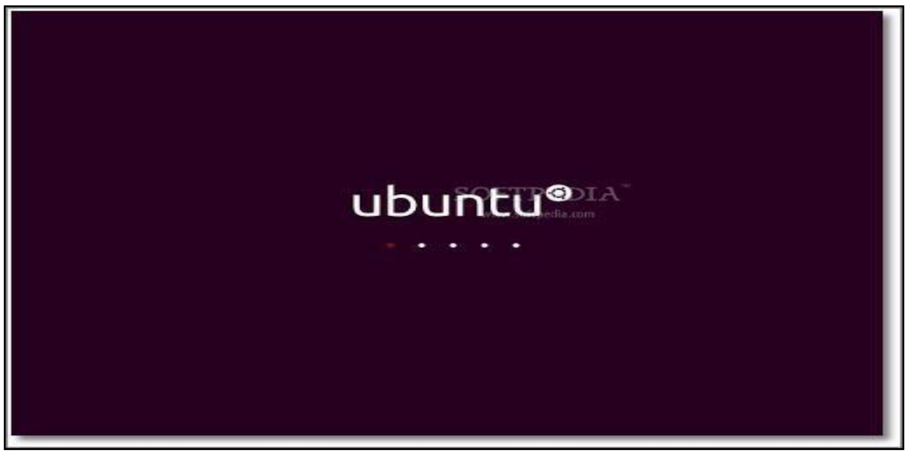
5. Find the Boot option in the setup utility. Its location depends on your BIOS.Select the Boot option from the menu, you can now see the options Hard Drive, CD-ROM Drive, Removable Devices Disk etc.
6. Change the boot sequence setting so that the CD-ROM is first. See the list of "Item



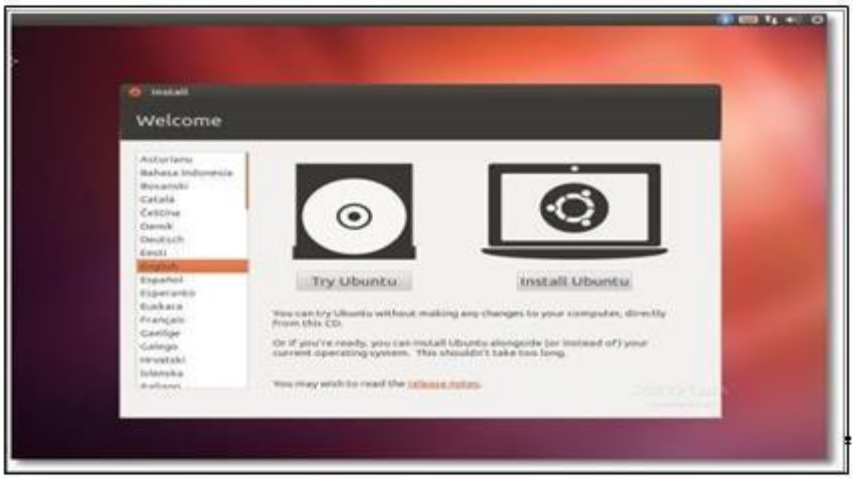
```
                       PhoenixBIOS Setup Utility
  Main     Advanced     Security     Power     Boot     Exit

                                              Item Specific Help

      CD-ROM Drive                          Keys used to view or
     +Removable Devices                     configure devices:
     +Hard Drive                            <Enter> expands or
      Network boot from AMD Am79C970A       collapses devices with
                                            a + or -
                                            <Ctrl+Enter> expands
                                            all
                                            <Shift + 1> enables or
                                            disables a device.
                                            <+> and <-> moves the
                                            device up or down.
                                            <n> May move removable
                                            device between Hard
                                            Disk or Removable Disk
                                            <d> Remove a device
                                            that is not installed.

 F1   Help   ↑↓  Select Item   -/+    Change Values          F9   Setup Defaults
 Esc  Exit   ↔   Select Menu   Enter  Select ▸ Sub-Menu      F10  Save and Exit
```

Specific Help" in right side of the window and find keys which is used to toggle to change the boot sequence.
7. Insert the Ubuntu Disk in CD/DVD drive.

8. Save your changes. Instructions on the screen tell you how to save the changes on your computer. The computer will restart with the changed settings. Machine should boot from CD ROM, Wait for the CD to load...



9. In a few minutes installation wizard will be started. Select your language and click the "Install Ubuntu" button to continue...

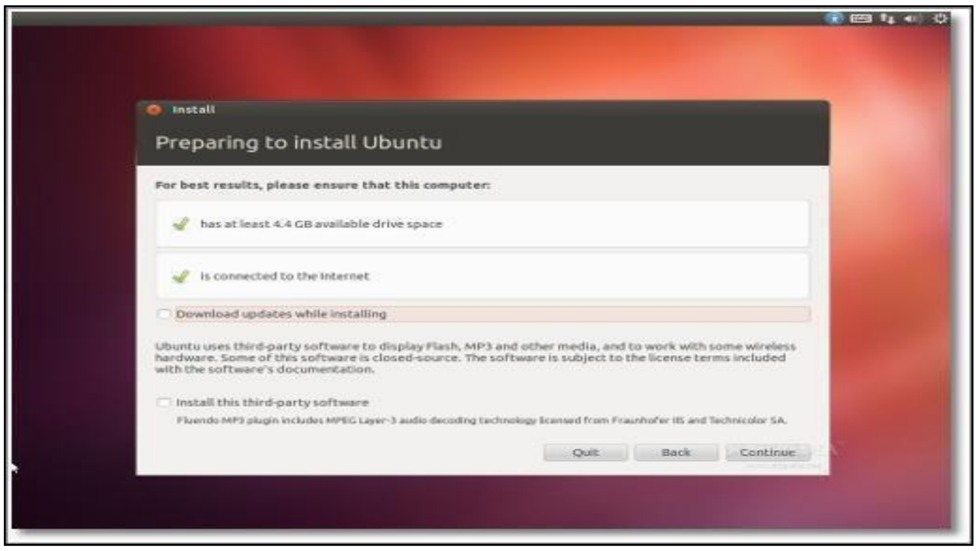


You can try Ubuntu without making any changes to your computer, directly from this CD.

Or if you're ready, you can install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long.

You may wish to read the release notes.

10. Optionally, you can choose to download updates while installing and/or install third party software, such as MP3 support. Be aware, though, that if you select those options, the entire installation process will be longer!


Install

Preparing to install Ubuntu

For best results, please ensure that this computer:

✓ has at least 4.4 GB available drive space

✓ is connected to the Internet

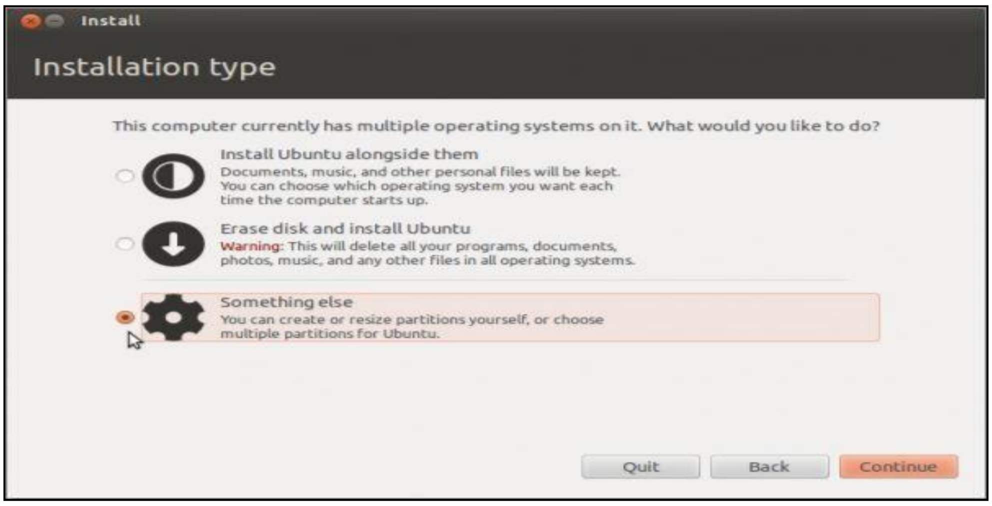
☐ Download updates while installing

Ubuntu uses third-party software to display Flash, MP3 and other media, and to work with some wireless hardware. Some of this software is closed-source. The software is subject to the license terms included with the software's documentation.

☐ Install this third-party software

Fluendo MP3 plugin includes MPEG Layer-3 audio decoding technology licensed from Fraunhofer IIS and Technicolor SA.

11. Since we are going to create partitions manually, select **Something else**, then click **Continue**. Keep in mind that even if you do not want to create partitions manually, it is better to select the same option as indicated here. This would insure that the installer will not overwrite your Windows , which will destroy your data. The assumption here is that **sdb** will be used just for Ubuntu 12.04, and that there are no valuable data on it.


Install

Installation type

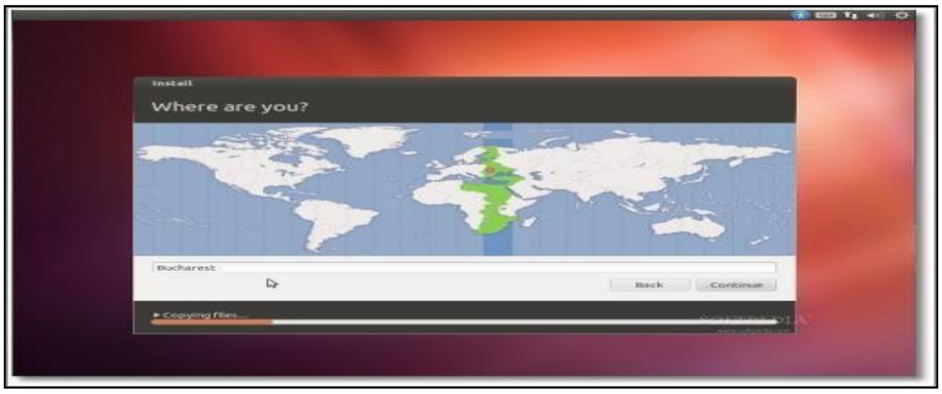
This computer currently has multiple operating systems on it. What would you like to do?

○ Install Ubuntu alongside them
Documents, music, and other personal files will be kept. You can choose which operating system you want each time the computer starts up.

○ Erase disk and install Ubuntu
Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems.

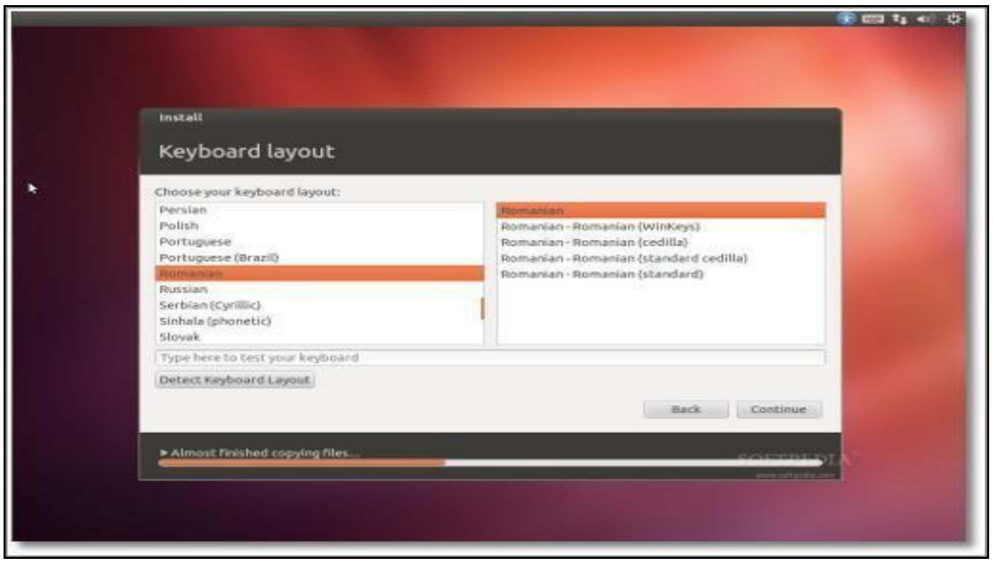
● Something else
You can create or resize partitions yourself, or choose multiple partitions for Ubuntu.

12. Where are you? Select your location and Click the "Continue" button.



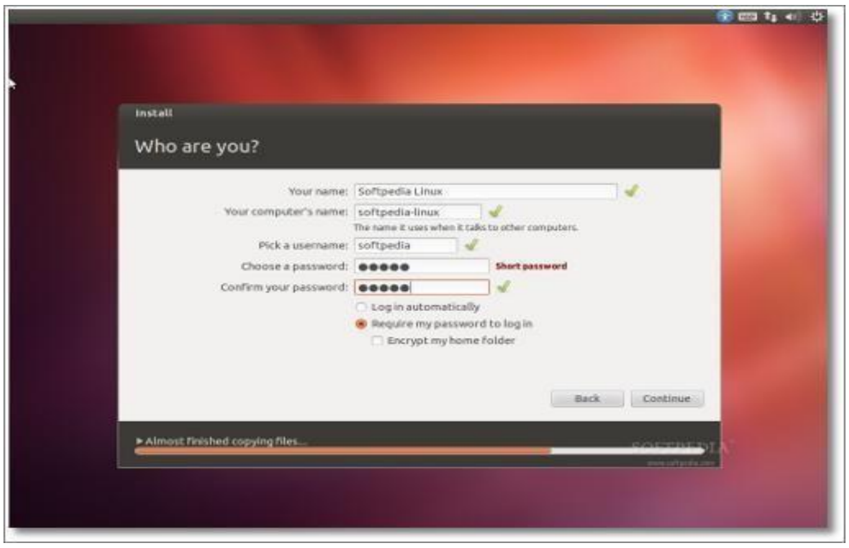
13. Keyboard layout

Select your keyboard layout and UK (English) and Click on "Continue" button.


Install
Keyboard layout
Choose your keyboard layout:
Persian
Polish
Portuguese
Portuguese (Brazil)
Romanian
Russian
Serbian (Cyrillic)
Sinhala (phonetic)
Slovak
Romanian
Romanian - Romanian (WinKeys)
Romanian - Romanian (cedilla)
Romanian - Romanian (standard cedilla)
Romanian - Romanian (standard)
Type here to test your keyboard
Detect Keyboard Layout
Back
Continue
Almost finished copying files...

14. Who are you?

Fill in the fields with your real name, the name of the computer (automatically generated, but can be overwritten), username, and the password.
Also at this step, there's an option called "Log in automatically." If you check it, you will automatically be logged in to the Ubuntu desktop without giving the password.
Option "Encrypt my home folder," will encrypt your home folder. Click on the "Continue" button to continue...


Install

Who are you?

Your name: Softpedia Linux ✓

Your computer's name: softpedia-linux ✓

The name it uses when it talks to other computers.

Pick a username: softpedia ✓

Choose a password: ●●●●● Short password

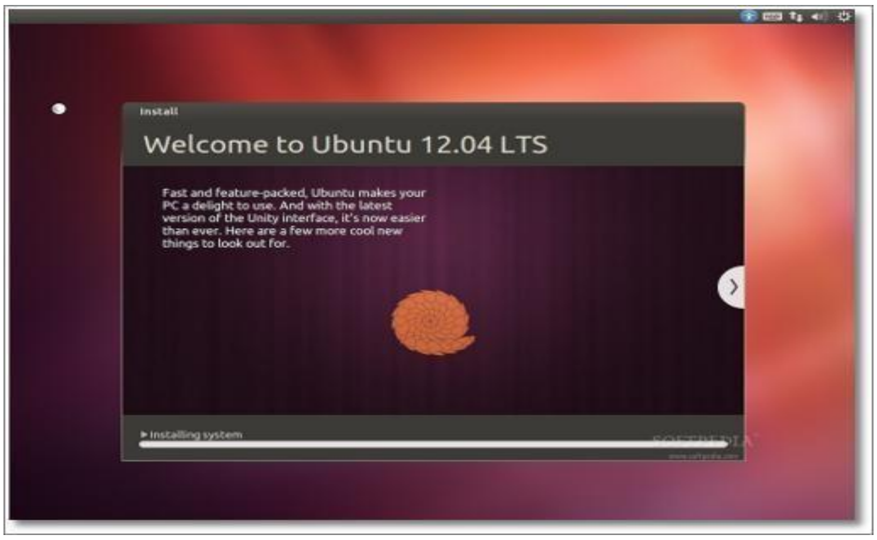
Confirm your password: ●●●●● ✓

○ Log in automatically

● Require my password to log in

☐ Encrypt my home folder

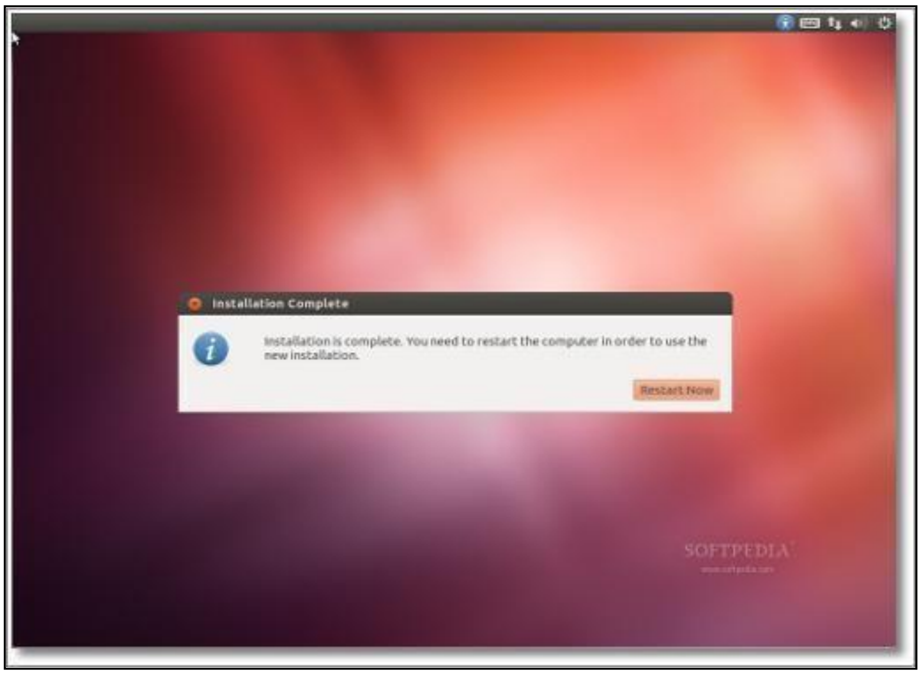
15. Now Ubuntu 12.04 LTS (Precise Pangolin) operating system will be installed.


Install

Welcome to Ubuntu 12.04 LTS

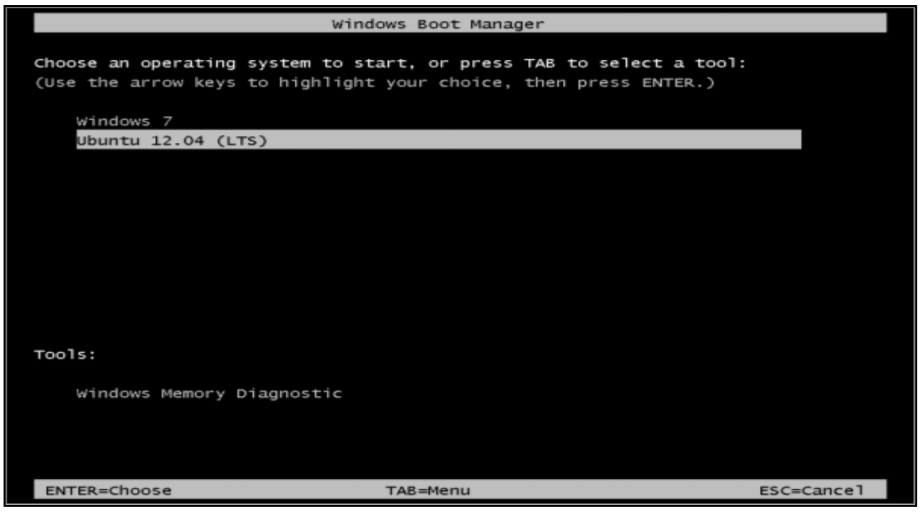
Fast and feature-packed, Ubuntu makes your PC a delight to use. And with the latest version of the Unity interface, it's now easier than ever. Here are a few more cool new things to look out for.

16. It will take approximately 10-12 minutes (depending on computer's speed), a pop-up window will appear, notifying you that the installation is complete, and you'll need to restart the computer in order to use the newly installed Ubuntu operating system. Click the "Restart Now" button.



Installation is complete. You need to restart the computer in order to use the new installation.

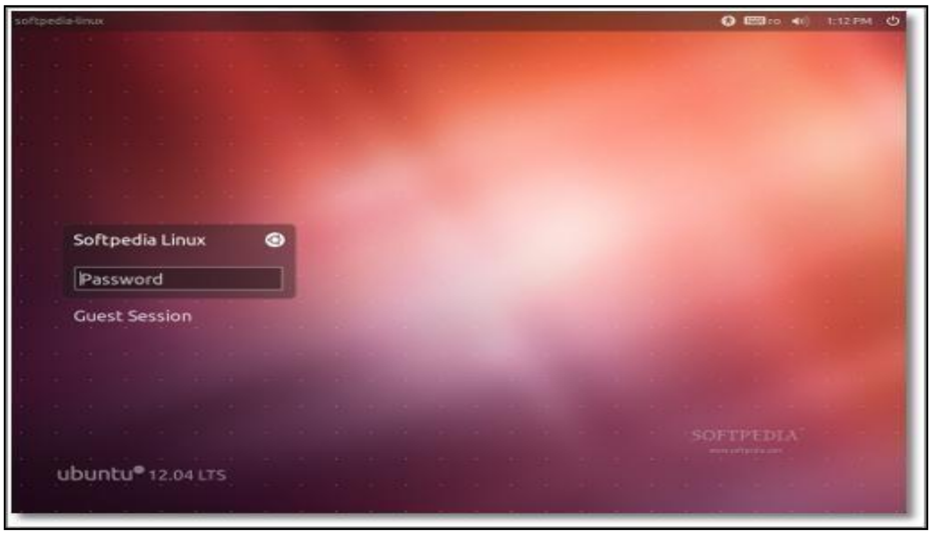
17. Please remove the CD and press the "Enter" key to reboot. The computer will be restarted. In a few seconds, you should see Windows 7′s boot menu with two entires listed – Windows 7 and Ubuntu 12.04 (LTS).Then you may choose to boot into Windows 7 or Ubuntu 12.04 using the UP/Down arrow key.



```
                         Windows Boot Manager

Choose an operating system to start, or press TAB to select a tool:
(Use the arrow keys to highlight your choice, then press ENTER.)

    Windows 7
    Ubuntu 12.04 (LTS)

Tools:

    Windows Memory Diagnostic

ENTER=Choose                    TAB=Menu                    ESC=Cancel
```

18. Please select Ubuntu 12.04 (LTS) and press Enter to boot the machine in Ubuntu 12.04 Linux.

19. Here you can see the users on the machine, Click on the user name and enter the password and press Enter key to login.



20. We have successfully installed and login to Ubuntu 12.04 LTS.

Result:

Thus the Linux operating system installation has been studied successfully.

Ex.No:2a **Basic Commands in UNIX**

Aim:

To study and execute UNIX commands.

UNIX Commands

1. **Cat Command**

   It is used to create a file, display the contents of a file and concatenating the files.

```
$cat > filename          /for create
$cat filename            /for display
$cat file1 file2 >file3  /for concatenate
```

2. **Date Command**

   It is used to display the current date, time, month and year.

```
$date +%d     /display date
$date +%m     /display month
$date +%h     /display month in words
$date +%y     /display year
$date +%R     /display the time with hour and mins
$date +%T     /display time with hour,mins and sec
```

1. **Calendar Command**

   It is used to display the calendar of the given month and year**.**

```
$cal year         /display the year calendar
$cal month year   /display the calendar of given month
```

2. **Who / who am i Command**

   It is used to display the data about all the users, who are currently logged into the system.

```
$who        /display all users
$who am I   /display about user
```

3. **Man command**

It is used to display the description and usage of particular command.

$man command name /display the description of the cmd

4. **Head Command**

It is used to display the text from top of the file content to mentioned line.

$head – (option) filename / display text from top

5. **Tail command**

It is used to display the text from bottom of the file content to mentioned line.

$tail – (option) filename / display text from bottom

6. **Wc Command**

It is used to count the number of lines, words and characters in the given file.

$wc filename /display no of lines, words and characters

7. **Copy Command**

It is used to copy the content from one file to another file.

$cp source destination /copy content from source to destination.

8. **Move Command**

It is used to rename the file.

$mv filename1 filename2 /for renaming

9. **Compare Command**

It is used to compare two sorted files line by line.

$cmp file1 file2 /to compare file1& 2

10. **Echo Command**

It is used to display whatever **message** we want to display on the screen.

$echo message /display the given msg

11. **Read Command**

It is used to get the user input from keyboard.

$read variable name /get input from keyboard

12. **Write Command**

It is used to send message to any logged in users. It’s a two way communications.

$write username /send msg

13. **Link Command**

It is used to link the content from one file to another file. It’s same as copy command

$ln source destination

O
r

```
$link
file1 file2                    /Link the two files
```

14. Directory Commands

It is used to making, changing and removing directories.

$mkdir dirname /to create directory
$cd dirname /to change working directory
$rmdir dirname /to remove the directory
$cd .. /to close the working directory

15. List Command

It is used to display list of files in the current working directory.

$ls –(option)

Options

a- List all directory entries
l- List files in long format.
r- List files in reverse order
t- List files in recently used order
s- List no of blocks(memory) used by the file

16. Remove Command

It is used to remove files from a directory.

$rm filename
Or
$rm –(option) filename /remove the file

Options

i- Ask user whether he wants to delete the file or not
r- Delete entries / entire content of the file recursively
f- Forcing to delete

17. Pwd Command

It is used to display current working directory.

$pwd /display current directory

18. Print Command

It is used to print the content of file.

$lp filename /print the file

19. Sort Command

It is used to sort the content in the file.

$sort filename /sort the content

20. Tty Command

It is used to know the terminal name that we are using.

$tty /display the terminal name

21. Bc Command

It is used as an online calculator.

$bc /open an online calculator

22. Message Command

It is used to avoid message from other users.

$mesg /to avoid the msg

23. Mail Command

It is used as a simple email utility available on UNIX system

$mail username /sends mail

24. Wall Command

It is used to send message to all users, those who are currently logged in.

$wall message /send msg to all users

25. News Command

It is used to permit users to read messages published by the system administrator.

$news /allow to read admin msg.

26. Grep Command (Global Regular Expression and Print)

It is used to search and print specified patterns from a file.

$grep text filename /search and print given text from file

27. Cut Command

It is used to select specified field from a line of text.

$cut –c(option) filename /cut a text

28. Paste Command

It is used to paste back the cut characters.

$paste filename /paste back the text

29. Common Command

It is used to compare two sorted files and compares each line of the first file with its corresponding line in the second file.

$comm file1 file2 /to compare the files

30. Difference Command

It is used to display file differences.

$diff file1 file2 /find the difference from the two identical files

31. Finger Command

It is used to gather and display the information about users, which includes login name, realname, home directory etc...

$finger username /display user details.

32. Password Command

It is used to change the password.

$passwd /to change password

33. Nl Command

It is used to add line number to file content.

$nl filename /add no to the file content

34. Which Command

It is used to report the path to the command or the shell alias in use

$which /to display the path

37. Clear Command

It is used to clear the screen.

$tput clear /to clear the screen

38. Reply Command

It is used to send reply to the specified user.

$reply username /to send reply

39. More Command

It is used to scroll your screen when your file content is too large.

$more filename /to scroll the screen

40. Compress Command

It is used to compress the file and save it as file.z.

$compress filename /to compress

Output:

FILE COMMANDS

1.Cat Command

```
[examuser1@linux ~]$ cat > file1
hi
Welcome
This is my first unix file
Thank You

[examuser1@linux ~]$ cat >file2
This is my second File
Thank You

[examuser1@linux ~]$ cat file1
hi
Welcome
This is my first unix file
Thank You

[examuser1@linux ~]$ cat file2
This is my second File
Thank You

[examuser1@linux ~]$ cat file1 file2 > file3
```

```
[examuser1@linux ~]$ cat file3
hi
Welcome
This is my first unix file
Thank You
This is my second File
Thank You
```

2.Copy Command

```
[examuser1@linux ~]$ cp file1 file4

[examuser1@linux ~]$ cat file4
hi
Welcome
This is my first unix file
Thank You
```

3.Move Command

```
[examuser1@linux ~]$  mv file4 file5

[examuser1@linux ~]$ cat file5
hi
Welcome
This is my first unix file
Thank You
```

4.Remove Command

```
[examuser1@linux ~]$ rm file5
[examuser1@linux ~]$  cat file5

cat: file5: No such file or directory
```

5.WC Command

```
[examuser1@linux ~]$  wc file3
      6      17      81 file3
```

WORKING WITH DIRECTORIES

6.Creating A Directory

```
[examuser1@linux ~]$ mkdir unix
```

7.Changing the working Directory

```
[examuser1@linux ~]$ cd unix
```

8.Current working Directory

```
[exam1@redhat unix]$ pwd
/home/exam1/unix

[exam1@redhat unix]$ cd ..
```

9**.The Path**

```
[examuser1@linux ~]$  echo $HOME
/home/exam1
```

10. **Moving files within directories**

```
[examuser1@linux ~]$  mv file4 unix
mv: cannot stat `file4': No such file or directory

[examuser1@linux ~]$ cat > file6
hello
unix world

[examuser1@linux ~]$ mv file6 unix

[examuser1@linux ~]$ cd unix

[exam1@redhat unix]$ cat file6
hello
unix world
```

11. Removing Directory

```
[examuser1@linux ~]$ cd unix
[exam1@redhat unix]$ rm file6
[exam1@redhat unix]$ cd ..
[examuser1@linux ~]$  rmdir unix
```

CALENDAR AND DATE COMMANDS

12. Calendar command - Year

```
[examuser1@linux ~]$ cal 2010
2010
```

```
      January                              February                           March

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

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

13. **Calendar command – Month of the**

Year[examuser1@linux ~]$ cal 5 2012

```
     May 2012
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
```

14. Date Commands

```
[examuser1@linux ~]$ date
Tue Jan  1 00:26:15 IST 2002
[examuser1@linux ~]$ date +%d
01
[examuser1@linux ~]$ date +%m
01
[examuser1@linux ~]$ date +%h
Jan
[examuser1@linux ~]$ date +%y
02
```

```
[examuser1@linux ~]$ date +%R
00:26
[examuser1@linux ~]$ date +%T
00:27:03
```

PIPES

15. Pipes in who command

```
[examuser1@linux ~]$  who | wc -l
      1
```

16. Longway pipeline

```
[examuser1@linux ~]$  ls | sort | wc -l
      5
```

17. Capturing output while using pipes : tee

```
[examuser1@linux ~]$ cat file3|wc|tee file4
      6      17      81

[examuser1@linux ~]$ cat file4
      6      17      81
```

OTHER BASIC COMMANDS

18. Who

```
[examuser1@linux ~]$ who
exam1    pts/1        Jan  1 00:02 (10.0.5.18)
```

19. who am i Command

```
[examuser1@linux ~]$  who am I
exam1    pts/1        Jan 1 00:02 (10.0.5.18)
```

20. Man command

```
[examuser1@linux ~]$ man cat
man cat
CAT(1)                         FSF                          CAT(1)

NAME
       cat - concatenate files and print on the standard output

SYNOPSIS
       cat [OPTION] [FILE]...

DESCRIPTION
```

```
Concatenate FILE(s), or standard input, to standard output.

-A, --show-all
      equivalent to -vET

-b, --number-nonblank
      number nonblank output lines

-e    equivalent to -vE

-E, --show-ends
      display $ at end of each line

-n, --number
      number all output lines
```

21.List Command

```
[examuser1@linux ~]$  ls -t
postfix.l file7 file4 file3 file2 file1 new
```

22.Print Command

```
[examuser1@linux ~]$  lp file3
lp: error - scheduler not responding!
```

23.Sort Command

```
[examuser1@linux ~]$ sort file3
hi
Thank You
Thank You
This is my first unix file
This is my second File
Welcome
```

24. Password Command

```
[examuser1@linux ~]$ passwd
Changing password for user exam1.
Changing password for exam1
(current) UNIX password:
You must wait longer to change your password
passwd: Authentication token manipulation error
```

25. **Which Command**

```
[examuser1@linux ~]$  which
Usage: /usr/bin/which [options] [--] programname [...]
Options: --version, -[vV] Print version and exit successfully.
        --help,          Print this help and exit successfully.
        --skip-dot       Skip directories in PATH that start with a dot.
        --skip-tilde     Skip directories in PATH that start with a tilde.
        --show-dot       Don't expand a dot to current directory in output.
        --show-tilde     Output a tilde for HOME directory for non-root.
        --tty-only       Stop processing options on the right if not on tty.
        --all, -a        Print all matches in PATH, not just the first
        --read-alias, -i Read list of aliases from stdin.
        --skip-alias     Ignore option --read-alias; don't read stdin.
        --read-functions Read shell functions from stdin.
        --skip-functions Ignore option --read-functions; don't read stdin.
```

Result:

Thus the basic UNIX commands have been studied and executed.

Ex: No: 2b **Shell Programming**

i. Biggest of Three Numbers

Aim:
To write a shell program for finding the biggest among 3 numbers
Algorithm:

```
1. Get the 3 values
2. Check if ‘a’ is greater than ‘b’
3. If step 2 is true, go to step 4. else, go to step 7
4. Check if ‘a’ is bigger than ‘c’
5. If step 4 is true, print “a is big”. else print “c is big”
6. Go to step 9
7. Check if ‘b’ is greater than ‘c’
8. If step 7 is true, print “b is big”. Else, print “c is big”
9. End of program
```

Program:

```
echo "enter a"
read a
echo "enter b"
read b
echo "enter c"
read c
if [ $a -gt $b -a $a -gt $c ]
then echo "a is big"
elif [ $b -gt $c ]
then echo "b is big"
else echo "c is big"
fi
```

Output:

```
[examuser1@linux ~]$ sh biggest.sh
enter a
5
enter b
4
enter c
2
a is big
```

Result:

Result:
Thus the shell program for finding the biggest among 3 numbers, has been written and executed successfully.

ii. Checking Odd or Even

Aim:

To write a shell program to find the given number is odd or even

Algorithm:

```
1. Get a number from the user, say num.
2. check if (num  % 2) = = 0
        2.1 Display the given number is even otherwise
        2.2 Display the given number is odd
3.  Stop the program
```

Program:

```
echo "enter any number"
read num
if [ `expr $num % 2` -eq 0 ]
then
echo number is even
else
echo number is odd
fi
```

Output:

```
[examuser1@linux ~]$ sh oddeven.sh
enter any number
5
number is odd
[examuser1@linux ~]$ sh oddeven.sh
enter any number
4
number is even
```

Result:

Thus the shell program for finding whether the given number is odd or even has been written and executed successfully

iii. Finding Factorial

Aim:

To write a shell program to find factorial of given number.

Algorithm:

```
1. Read a number say n.
2. Initialize i=1,f=1
3. Repeat until I is leass than n.
   3.1.f=f*i
   3.2.i=i+1
4. Display factorial (f) of n
5. Stop
```

Program:

```
echo "enter number"
read n
i=1
f=1
while [ $i -le $n ]
do
f=`expr $f \* $i`
i=`expr $i + 1`
done
echo "Factorial is.. $f"
```

Output:

```
 [examuser1@linux ~]$ sh fact.sh
enter number
5
Factorial is.. 120
```

Result:

Thus the shell program to find factorial of given number has been written and executed successfully.

iv. Arithmetic Operations

Aim:

To write a shell program for implementing arithmetic operations.

Algorithm:

```
1. Display menu to user.
        Say, 1.Add 2. Sub 3. Mul 4. Div 5.exit
2.Prompt user to enter 2 values (say a, b) and enter choice of operation.
3. Using switch case statement, use choice value for processing output accordingly.
        3.1.If choice=1, return sum (a+b)
        3.2. If choice=2, return difference (a-b)
        3.3. If choice=3, return product (a*b)
        3.4. If choice=4, return quotient (a/b)
4Display result.
```

.

Program:

```
echo "Enter two numbers"
read a b
echo "1.Add 2.Sub 3.Mul 4.Div 5.Exit"
read op
case $op in
1)c=`expr $a + $b`;;
2)c=`expr $a - $b`;;
3)c=`expr $a \* $b`;;
4)c=`expr $a / $b`;;
5)exit
esac
echo $c
```

Output:

```
[examuser1@linux ~]$ sh case.sh
Enter two numbers
5 4
1.Add 2.Sub 3.Mul 4.Div 5.Exit
1
9
[examuser1@linux ~]$ sh case.sh
Enter two numbers
5 4
1.Add 2.Sub 3.Mul 4.Div 5.Exit
2
1
[examuser1@linux ~]$ sh case.sh
Enter two numbers
5 4
1.Add 2.Sub 3.Mul 4.Div 5.Exit
3
20
```

```
[examuser1@linux ~]$ sh case.sh
Enter two numbers
8 4
1.Add 2.Sub 3.Mul 4.Div 5.Exit
4
2
```

Result:

Thus the shell program for implementing arithmetic operations has been written and executed successfully.

EX. NO. 3a Implementation of Process Management using fork and getpid system calls

Aim:

To create a new child process using fork system call and implement getpid system call.

Algorithm

```
1. Declare a variable x to be shared by both child and parent.
2. Create a child process using fork system call.
3. If return value is -1 then
        a. Print "Process creation unsuccessfull"
        b. Terminate using exit system call.
4. If return value is 0 then
        a. Print "Child process"
        b. Print process id of the child using getpid system call
        c. Print value of x
        d. Print process id of the parent using getppid system call
5. Otherwise
        a. Print "Parent process"
        b. Print process id of the parent using getpid system call
        c. Print value of x
        d. Print process id of the shell using getppid system call.
6. Stop
```

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
#include<sys/types.h>
main()
{
pid_t pid;
int x=5;
pid=fork();
x++;
if(pid<0)
{
printf("process creation error");
exit(-1);
}
else if(pid==0)
{
printf("child process:");
printf("\n process id is %d",getpid());
printf("\n value of x is %d",x);
printf("\n process id of parent is%d\n",getppid());
}
else
{
```

```
printf("\n parent process:");
printf("process id is %d",getpid());
printf("\n value of x is %d",x);
printf("\n process id of shell is %d\n",getppid());
}
}
```

Output:

```
[examuser1@linux ~]$ cc fork.c
[examuser1@linux ~]$ ./a.out
child process:

 process id is 7353
 value of x is 6
 process id of parent is7352

 parent process:

 process id is 7352
 value of x is 6
 process id of shell is 7122
```

Result

Thus a child process is created with copy of its parent's address space.

EX. NO. 3b Implementation of Process Management using wait system call

Aim:

To block a parent process until child completes using wait system call.

Algorithm:

```
1. Create a child process using fork system call.
2. If return value is -1 then
    a. Print "Process creation unsuccessfull"
3. Terminate using exit system call.
4. If return value is > 0 then
    a. Suspend parent process until child completes using wait system call
    b. Print "Parent starts"
    c. Print even numbers from 0–10
    d. Print "Parent ends"
5. If return value is 0 then
    a. Print "Child starts"
    b. Print odd numbers from 0–10
    c. Print "Child ends"
6. Stop
```

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/wait.h>
main()
{
int i,status;
pid_t pid;
pid=fork();
if(pid<0)
{
printf("\n process creation failure\n");
exit(-1);
}
else if(pid>0)
{
wait(NULL);
printf("\n parent starts \n even nos:");
for(i=2;i<=10;i+=2)
printf("%3d",i);
printf("\n parent ends\n");
}
else if(pid==0)
{
printf("child starts \n odd nos:");
for(i=1;i<10;i+=2)
printf("%3d",i);
printf("\n child ends\n");
}
}
```

Output:

```
[examuser1@linux ~]$ cc wait.c
[examuser1@linux ~]$ ./a.out

 child starts
 odd nos: 1 3 5 7 9
 child ends

 parent starts
 even nos: 2 4 6 8 10
 parent ends
```

Result

Thus using wait system call zombie child processes were avoided.

EX. NO. 3c Implementation of Process Management using exec system call

Aim:

To load an executable program in a child processes exec system call.

Algorithm:

```
1. If no. of command line arguments  3 then stop.
2. Create a child process using fork system call.
3. If return value is -1 then
    a. Print "Process creation unsuccessfull"
    b. Terminate using exit system call.
4. If return value is > 0 then
    a. Suspend parent process until child completes using wait system call
    b. Print "Child Terminated".
    c. Terminate the parent process.
5. If return value is 0 then
    a. Print "Child starts"
    b. Load the program in the given path into child process using exec system
       call.
    c. If return value of exec is negative then print the exception and stop.
    d. Terminate the child process.
6. Stop
```

Program:

```
#include<stdio.h>
#include<sys/types.h>
#include<unistd.h>
#include<stdlib.h>
main(int argc,char *argv[])
{
pid_t pid;
int i;
if(argc!=3)
{
printf("\n insufficient arguments load program");
printf("\n usage:./a.out <path> <cmd> \n");
exit(-1);
}
switch(pid=fork())
{
case -1:
printf("fork failed");
exit(-1);
case 0:
printf("child process\n");
i=execl(argv[1],argv[2],0);
if(i<0)
{
printf("%s program not loaded using exec system call \n",argv[2]);
exit(-1);
}
default:
wait(NULL);
printf("child terminated \n");
exit(0);
}
}
```

Output:

```
[examuser1@linux ~]$ cc exec.c
[examuser1@linux ~]$ ./a.out /usr/bin/who who
child process
root     :0           Jan 11 22:51
exam1    pts/1        Jan 11 22:58 (10.0.5.25)
exam43   pts/4        Jan 11 23:16 (10.0.5.134)
exam40   pts/5        Jan 11 23:16 (10.0.5.136)
exam31   pts/6        Jan 11 23:18 (10.0.5.138)
exam42   pts/7        Jan 11 23:20 (10.0.5.135)
exam39   pts/8        Jan 11 23:21 (10.0.5.137)
exam34   pts/3        Jan 12 00:02 (10.0.5.146)
exam35   pts/9        Jan 12 00:20 (10.0.5.148)
exam33   pts/10       Jan 12 00:26 (10.0.5.151)
exam38   pts/11       Jan 12 00:32 (10.0.5.156)
exam28   pts/12       Jan 12 00:42 (10.0.5.157)
exam24   pts/2        Jan 12 00:42 (10.0.5.158)
exam36   pts/0        Jan 12 00:45 (10.0.5.149)
exam32   pts/13       Jan 12 00:49 (10.0.5.152)
child terminated
```

Result

Thus the child process loads a binary executable file into its address space.

EX. NO. 3d. Implementation of Process Management using system calls: open, read, write, close, exit

Aim:

To implement UNIX I/O system calls open ,read , write,close and exit.

Algorithm:

```
1. Declare a character buffer buf to store 100 bytes.
2. Get the new filename as command line argument.
3. Create a file with the given name using open system call with O_CREAT and
O_TRUNC options.
4. Check the file descriptor.
    a) If file creation is unsuccessful, then stop.
5. Get input from the console until user types Ctrl+D
    a) Read 100 bytes (max.) from console and store onto buf using read system
    call
    b) Write length of buf onto file using write system call.
6. Close the file using close system call.
7. Stop
```

Program:

```
#include <stdlib.h>
#include <string.h>
#include <fcntl.h>
main(int argc, char *argv[])
{
int fd, n, len;
char buf[100];
if (argc != 2)
{
printf("Usage: ./a.out <filename>\n");
exit(-1);
}
fd = open(argv[1], O_WRONLY|O_CREAT|O_TRUNC, 0644);
if(fd < 0)
{
printf("File creation problem\n");
exit(-1);
}
printf("\n The execution of creat & write system calls:\n");
printf("Press Ctrl+D at end in a new line:\n");

while((n = read(0, buf, sizeof(buf))) > 0)
{
len = strlen(buf);
write(fd, buf, len);
}
close(fd);
printf("\nFile has been created and contents are written in the file\n");
fd = open(argv[1], O_RDONLY);
if(fd == -1)
{
printf("%s file does not exist\n", argv[1]);
exit(-1);
}
printf("\nExecution of read system call:\n");
printf("\nOpening the file %s to read\n",argv[1]);
printf("Contents of the file %s is : \n", argv[1]);
while(read(fd, buf, sizeof(buf)) > 0)
printf("%s", buf);
close(fd);
}
```

Output:

```
[examuser1@linux ~]$ cc orw.c
[examuser1@linux ~]$ ./a.out os.txt

 The execution of creat & write system calls:
Press Ctrl+D at end in a new line:

System calls provide interface between a process and the operating system.

File has been created and contents are written in the file

Execution of read system call:

Opening the file os.txt to read
Contents of the file os.txt is :

System calls provide interface between a process and the operating system.
```

Result:

Thus the program for implementing system calls open,read, write,close and exit have been executed successfully.

Ex.No.: 4 Implementation of various CPU Scheduling Algorithms

Ex.No.4a FIRST COME FIRST SERVE SCHEDULING

Aim:

To write a program in C to implement the FCFS Gantt Chart

Algorithm:

1. Start the program.
2. Get the number of process to be executed
3. Get the process name and its burst time.
4. Calculate the waiting time and turn around time for each process
5. Draw the Gantt chart using the graphics mode.
6. Stop the program.

Program:

```
#include<stdio.h>
struct process
{
int btime,wtime,ttime;
}p[50];
main()
{
int n,i,j,h,c;
float tot_turn=0.0,tot_wait=0.0,avg_turn=0.0,avg_wait=0.0;
printf("\n\n\t\t\t\tFIRST COME FIRST SERVE SCHEDULING\n\n");
printf("\t\t\t\t*********************************\n");
printf("Enter the number of process=");
scanf("%d",&n);
printf("\n");
for(i=1;i<=n;i++)
{
printf("Enter the burst time %d:",i);
scanf("%d",&p[i].btime);
}
i=1;
p[i].wtime=0;
p[i].ttime=p[i].btime;
tot_wait=p[i].wtime;
tot_turn=p[i].ttime;
for(i=2;i<=n;i++)
{
p[i].wtime=p[i-1].wtime+p[i-1].btime;
p[i].ttime=p[i].wtime+p[i].btime;
tot_wait=tot_wait+p[i].wtime;
tot_turn=tot_turn+p[i].ttime;
}
avg_wait=tot_wait/n;
avg_turn=tot_turn/n;
printf("\nProcess No \tBurst Time \tWaiting Time \tTurn Around Time");
for(i=1;i<=n;i++)
{
printf("\n%d\t\t%d\t\t%d\t\t%d",i,p[i].btime,p[i].wtime,p[i].ttime);
}
printf("\n\nAverage Waiting Time=%f",avg_wait);
printf("\nAverage Turn Around Time=%f",avg_turn);
printf("\n");
printf("\n\t\t\t\tGANTT CHART");
printf("\n\t\t\t\t***********\n\n");
for(i=1;i<=n;i++)
{
printf("%d",p[i].wtime);
for(j=1;j<=p[i].btime;j++)
printf("_");
}
for(i=1;i<=n;i++)
{
c=p[i].wtime+p[i].btime;
}
printf("%d",c);
printf("\n\n");
return 0;
}
```

Output:

```
[examuser1@linux ~]$ cc FCFS_Gantt.c
[examuser1@linux ~]$ ./a.out

FIRST COME FIRST SERVE SCHEDULING
********************************

Enter the number of process=5

Enter the burst time 1:10
Enter the burst time 2:5
Enter the burst time 3:2
Enter the burst time 4:3
Enter the burst time 5:5

Process No          Burst Time      Waiting Time    Turn Around Time
1                   10               0              10
2                   5               10              15
3                   2               15              17
4                   3               17              20
5                   5               20              25

Average Waiting Time=12.400000
Average Turn Around Time=17.400000

GANTT CHART
***********
0__________10_____15__17___20_____25
```

Result:

Thus the program to implement FCFS scheduling algorithm has been written and executed successfully.

Ex.No.4b Shortest Job First Scheduling

Aim:

To write a program in C to implement the SJF scheduling algorithm.

Algorithm:

1. Start the process.
2. Declare the array size.
3. Get the number of elements to be inserted.
4. Select the process which has shortest burst time will execute first.
5. If two processes have same burst length then FCFS scheduling algorithm used.
6. Make the average waiting length of next process.
7. Start with the first process from its selection as above and let the other process in queue.
8. Calculate the total number of burst time
9. Display the values.
10. Terminate the process.

Program:

```
#include<stdio.h>
main()
{
int i,j,n,t,d,h,tot=0,tt=0,p[20],c[20],a[20];
printf("\n\t\t\t\tSHORTEST JOB FIRST SCHEDULING\n");
printf("\t\t\t\t******************************\n\n");
printf("Enter the number of process:");
scanf("%d",&n);
printf("\nEnter the %d process\n",n);
for(i=0;i<n;i++)
scanf("%d",&p[i]);
for(i=0;i<n-1;i++)
for(j=i+1;j<n;j++)
if(p[i]>p[j])
{
t=p[i];
p[i]=p[j];
p[j]=t;
}
printf("\nSorted Process\n");
for(i=0;i<n;i++)
printf("%d\n",p[i]);
c[0]=0;
for(i=0;i<n-1;i++)
c[i+1]=c[i]+p[i];
for(i=0;i<n;i++)
a[i]=c[i]+p[i];
printf("\nP.No \tProcess \tWaiting Time \tTurn Around Time");
for(i=0;i<n;i++)
{
printf("\n%d\t%d\t\t%d\t\t%d",i+1,p[i],c[i],a[i]);
tot=tot+c[i];
tt=tt+a[i];
}
printf("\n\nAverage Waiting Time %f",((float)tot/n));
printf("\nAverage Turn Around Time %f",((float)tt/n));
printf("\n");
printf("\n\n\t\t\t\t\tGANTT CHART");
printf("\n\n\t\t\t\t\t***********");
printf("\n\n\t\t\t\t");
for(i=0;i<n;i++)
{
printf("%d",c[i]);
for(j=1;j<p[i];j++)
printf("_");
}
for(i=1;i<n;i++)
{
d=c[i]+p[i];
}
printf("%d",d);
printf("\n\n");
return 0;
}
```

Output:

```
[examuser1@linux ~]$ cc Gntt_SJF.c
[examuser1@linux ~]$ ./a.out

SHORTEST JOB FIRST SCHEDULING
*****************************
Enter the number of process:5
Enter the 5 process
10
5
3
1
8
Sorted Process
1
3
5
8
```

```
10

P.No            Process      Waiting Time    Turn Around Time
1               1            0          1
2               3            1          4
3               5                  4          9
4               8                  9          17
5               10                 17          27
Average Waiting Time 6.200000
Average Turn Around Time 11.600000

GANTT CHART
***********
01__4____9_______17_________27
```

Result:

Thus the program to implement shortest job first scheduling algorithm has been written and executed successfully.

Ex.No.4c Priority Scheduling

Aim:

To write a program in C to implement the priority scheduling algorithm.

Algorithm:

1. Start the program.
2. Initialize the variables in structure.
3. Get the number of process, priority and burst time from the user.
4. Start the process execution according to the priority.
5. The total execution time is calculated by adding the burst time.
6. Calculate the average waiting time and turnaround time using total execution and waiting time
7. Terminate the program.

Program:

```
#include<stdio.h>
main()
{
int n,b[10],w[10],i,j,h,t,tt,d;
int stime[10],a[10],p[10];
float avg=0;
printf("\n\t\t\t\tPRIORITY SCHEDULING ALGORITHM");
printf("\n\t\t\t\t*****************************\n");
printf("Enter how many jobs:");
scanf("%d",&n);
printf("\nEnter burst time & priority for corresponding job\n\n");
for(i=1;i<=n;i++)
{
printf("Process %d:",i);
scanf("%d %d",&b[i],&p[i]);
a[i]=i;
}
for(i=1;i<=n;i++)
for(j=i;j<=n;j++)
if(p[i]>p[j])
{
t=b[i];
tt=a[i];
b[i]=b[j];
a[i]=a[j];
b[j]=t;
a[j]=tt;
}
w[1]=0;
printf("\nProcess %d Waiting Time:0",a[1]);
for(i=2;i<=n;i++)
{
```

```
w[i]=b[i-1]+w[i-1];
printf("\nProcess %d waiting time:%d",a[i],w[i]);
avg+=w[i];
}
printf("\nTotal Waiting Time:%f",avg);
printf("\nAverage Waiting Time=%f\n",avg/n);
printf("\nGANTT CHART");
printf("\n***********\n\n");
for(i=1;i<=n;i++)
{
printf("%d ",b[i]);
}
printf("\n\n");
for(i=1;i<=n;i++)
{
printf("%d",w[i]);
for(j=1;j<=b[i];j++)
printf("_");
}
for(i=1;i<=n;i++)
{
d=w[i]+b[i];
}
printf("%d",d);
return 0;
}
```

Output:

```
[examuser1@linux ~]$ cc pri_gantt.c
[examuser1@linux ~]$ ./a.out

PRIORITY SCHEDULING ALGORITHM
****************************
Enter how many jobs:5
Enter burst time & priority for corresponding job
Process 1:10 3
Process 2:1 1
Process 3:2 3
Process 4:1 4
Process 5:5 2

Process 5 Waiting Time:0
Process 1 waiting time:5
Process 2 waiting time:15
Process 3 waiting time:16
Process 4 waiting time:18

Total Waiting Time:54.000000
Average Waiting Time=10.800000
```

```
GANTT CHART
***********

5 10 1 2 1

0_____5__________15_16__18_19
```

Result:

Thus the program to implement priority scheduling algorithm has been written and executed successfully.

Ex.4d **Round Robin Scheduling**

Aim:

To write a program to implement the Round Robin CPU scheduling Algorithm

Algorithm:

```
1. Start the program
2. Get the number of processors
3. Get the Burst time(BT) of each processors
4. Get the Quantum time(QT)  or time slice.
5. Execute each processor until reach the QT or BT
6. Time of reaching processor’s BT is it’s Turn Around Time(TAT)
7. Time waits to start the execution, is the waiting time(WT) of each processor
8. Calculation of Turn Around Time and Waiting Time
       8.1.tot_TAT = tot_TAT + cur_TAT
       8.2.avg_TAT = tot_TAT/num_of_proc
       8.3.tot_WT = tot_WT + cur_WT
       8.4.avg_WT = tot_WT/num_of_proc
9. Display the result
10. STOP the program
```

Program:

```
#include<stdio.h>
int n,b[10],z[10],q,i,j,r,m[50],e=0,avg=0;
float f;
main()
{
printf("\n\n\t\t\t\t\tROUND ROBIN\n\n");
printf("\t\t\t\t\t******************\n");
printf("Enter how many jobs:");
scanf("%d",&n);
printf("\nEnter burst time for corresponding job..\n");
printf("\n");
for(i=1;i<=n;i++)
{
printf("Process %d:",i);
scanf("%d",&b[i]);
z[i]=b[i];
}
printf("\nEnter the time slice value:");
scanf("%d",&q);
rr();//no return type with no argument function
average();
return 0;
}
rr()
{
int max=0;
max=b[1];
for(j=1;j<=n;j++)
if(max<=b[j])
```

```
max=b[j];
if((max%q)==0)
r=(max/q);
else
r=(max/q)+1;
for(i=1;i<=r;i++)
{
printf("\n\nRound %d",i);
for(j=1;j<=n;j++)
{
if(b[j]>0)
{
b[j]=b[j]-q;
if(b[j]<=0)
{
b[j]=0;

printf("\nProcess %d is completed",j);
}
else
{
printf("\nProcess %d remaining time is %d",j,b[j]);
}
}
}
}
return 0;
}
average()
{
for(i=1;i<=n;i++)
{
e=0;
for(j=1;j<=r;j++)
{
if(z[i]!=0)
{
if(z[i]>=q)
{
m[i+e]=q;
z[i]-=q;
}
else
{
m[i+e]=z[i];
z[i]=0;
}
}
else
m[i+e]=0;
e=e+n;
}
}
for(i=2;i<=n;i++)
for(j=1;j<=i-1;j++)
avg=avg+m[j];
for(i=n+1;i<=r*n;i++)
{
if(m[i]!=0)
{
for(j=i-(n-1);j<=i-1;j++)
avg=m[j]+avg;
}
}
f=avg/n;
printf("\n\nTotal Waiting:%d",avg);
printf("\n\nAverage Waiting Time:%f\n",f);
printf("\n\t\t\t\tGANTT CHART");
printf("\n\t\t\t\t***********\n\n");
for(i=1;i<=r*n;i++)
{
if(m[i]!=0)
{
if(i%n==0)
{
printf("P%d",(i%n)+(n));
}
else
{
printf("P%d",(i%n));
for(j=1;j<=m[i];j++)
printf("_",h);
}
}
}
printf("\n\n\n");
return 0;
}
```

Output:

```
[examuser1@linux ~]$ cc rr_gantt.c
[examuser1@linux ~]$ ./a.out

ROUND ROBIN
***********
Enter how many jobs:5

Enter burst time for corresponding job..
```

```
Process 1:3
Process 2:5
Process 3:2
Process 4:5
Process 5:5

Enter the time slice value:2


Round 1
Process 1 remaining time is 1
Process 2 remaining time is 3
Process 3 is completed
Process 4 remaining time is 3
Process 5 remaining time is 3

Round 2
Process 1 is completed
Process 2 remaining time is 1
Process 4 remaining time is 1
Process 5 remaining time is 1

Round 3
Process 2 is completed
Process 4 is completed
Process 5 is completed

Total Waiting:54

Average Waiting Time:10.000000

GANTT CHART
***********
P1__P2__P3__P4__P5P1_P2__P4__P5P2_P4_P5
```

Result:

Thus the program to implement round robin scheduling algorithm has been written and executed successfully.

Ex: No: 5 Illustration of Interprocess Communication using Shared Memory

Aim:

To write a C program to implement inter process communication using shared memory .

Algorithm:

1. Start the Program
2. Obtain the required process id
3. Increment the *ptr=*ptr+1;
4. Print the process identifier.
5. Check the values of sem_num, sem_op, sem_flg.
6. Stop the execution.

Program:

```
#include<stdio.h>
#include<sys/shm.h>
#include<sys/ipc.h>
int main()
{
int child,shmid,i;
char *shmptr;
child=fork();
if(!child)
{
shmid=shmget(2041,32,0666|IPC_CREAT);
shmptr=shmat(shmid,0,0);
printf("\n Parent writing\n");
for(i=0;i<10;i++)
{
shmptr[i]='a'+i;
putchar(shmptr[i]);
}
}
else
{
shmid=shmget(2041,32,0666);
shmptr=shmat(shmid,0,0);
printf("\n child is reading\n");
for(i=0;i<10;i++)
putchar(shmptr[i]);
shmdt(NULL);
shmctl(shmid,IPC_RMID,NULL);
}
return 0;
}
```

Output:

```
[examuser1@linux ~]$cc memory.c
[examuser1@linux ~]$./a.out

 Parent writing
abcdefghij

 child is reading
abcdefghij
```

Result:

Thus the program to implement interprocess communication using shared memory has been written and executed successfully.

Ex.No:6 Implementation of Mutex for Producer Consumer Problem by Semaphores

Aim:

To write a C-program to implement mutex for the producer – consumer problem by semaphores.

Algorithm:

1. Start the program.
2. Declare the required variables.
3. Initialize the buffer size and get maximum item you want to produce.
4. Get the option, which you want to do either producer, consumer or exit from the operation.
5. If you select the producer, check the buffer size if it is full the producer should not produce the item or otherwise produce the item and increase the value buffer size.
6. If you select the consumer, check the buffer size if it is empty the consumer should not consume the item or otherwise consume the item and decrease the value of buffer size.
7. If you select exit come out of the program.
8. Stop the program.

Program:

```
#include<stdio.h>

int mutex=1,full=0,empty=3,x=0;

 main()

{

int n;

void producer();

void consumer();

int wait(int);

int signal(int);

printf("\n1.PRODUCER\n2.CONSUMER\n3.EXIT\n");
```

```
 while(1)
 {
 printf("\nENTER YOUR CHOICE\n");
scanf("%d",&n);
 switch(n)
 {
case 1:
if((mutex==1)&&(empty!=0))
producer();
else
printf("BUFFER IS FULL");
break;
case 2:
if((mutex==1)&&(full!=0))
consumer();
else
printf("BUFFER IS EMPTY");
break;
case  3:
exit(0);
break;
}
}
}
 int wait(int s)
 {
return(--s);
```

```
 }
 int signal(int s)
{
return(++s);
}
void producer()
 {
 mutex=wait(mutex);
full=signal(full);
empty=wait(empty);
x++;
 printf("\nproducer produces the item%d",x);
 mutex=signal(mutex);
}
void consumer()
 {
 mutex=wait(mutex);
 full=wait(full);
 empty=signal(empty);
 printf("\n consumer consumes item%d",x);
x--;
 mutex=signal(mutex);
 }
```

Output:

```
[examuser1@linux ~]$vi semaphore.c
[examuser1@linux ~]$cc semaphore.c
[examuser1@linux ~]$ ./a.out
```

```
1.PRODUCER

2.CONSUMER

3.EXIT


ENTER YOUR CHOICE  1

producer produces the item1

ENTER YOUR CHOICE 1

producer produces the item2

ENTER YOUR CHOICE 2

 consumer consumes item2

ENTER YOUR CHOICE 2

 consumer consumes item1

ENTER YOUR CHOICE 2

BUFFER IS EMPTY

ENTER YOUR CHOICE 1

producer produces the item1

ENTER YOUR CHOICE 1

producer produces the item2

ENTER YOUR CHOICE 3
```

Result:

Thus the C program to implement mutex for the producer – consumer problem by semaphores has been written and executed successfully.

Ex.No:7 Implementation of Bankers algorithm for Deadlock Avoidance

Aim:

To write a C program to implement bankers algorithm for dead lock avoidance

Algorithm:

1. Start the Program
2. Get the values of resources and processes.
3. Get the avail value.
4. After allocation find the need value.
5. Check whether its possible to allocate. If possible it is safe state
6. If the new request comes then check that the system is in safety or not if we allow the request.

7.Stop the execution

Program:

```
#include<stdio.h>
int max[100][100];
int alloc[100][100];
int need[100][100];
int avail[100];
int n,r;
void input();
void show();
void cal();
int main()
{
 int i,j;
  input();
 show();
 cal();
  return 0;
}
void input()
{
 int i,j;
 printf("Enter the no of Processes\t");
 scanf("%d",&n);
 printf("Enter the no of resources instances\t");
 scanf("%d",&r);
 printf("Enter the Max Matrix\n");
 for(i=0;i<n;i++)
 {
  for(j=0;j<r;j++)
  {
   scanf("%d",&max[i][j]);
  }
 }
 printf("Enter the Allocation Matrix\n");
 for(i=0;i<n;i++)
 {
  for(j=0;j<r;j++)
  {
   scanf("%d",&alloc[i][j]);
  }
 }
 printf("Enter the available Resources\n");
 for(j=0;j<r;j++)
 {
  scanf("%d",&avail[j]);
 }
}
void show()
{
 int i,j;
 printf("Process\t Allocation\t Max\t Available\t");
 for(i=0;i<n;i++)
 {
  printf("\nP%d\t ",i+1);
  for(j=0;j<r;j++)
  {
   printf("%d ",alloc[i][j]);
  }
  printf("\t");
  for(j=0;j<r;j++)
  {
   printf("%d ",max[i][j]);
  }
  printf("\t");
  if(i==0)
  {
   for(j=0;j<r;j++)
   printf("%d ",avail[j]);
  }
 }
}
void cal()
{
 int finish[100],temp,need[100][100],flag=1,k,c1=0;
 int safe[100];
 int i,j;
 for(i=0;i<n;i++)
 {
  finish[i]=0;
 }
 //find need matrix
 for(i=0;i<n;i++)
 {
  for(j=0;j<r;j++)
 {
  need[i][j]=max[i][j]-alloc[i][j];
 }
}
printf("\n");
while(flag)
{
 flag=0;
  for(i=0;i<n;i++)
 {
  int c=0;
  for(j=0;j<r;j++)
   {
   if((finish[i]==0)&&(need[i][j]<=avail[j]))
   {
      c++;
    if(c==r)
    {
     for(k=0;k<r;k++)
     {
      avail[k]+=alloc[i][j];
      finish[i]=1;
      flag=1;
          }
     printf("P%d->",i);
     if(finish[i]==1)
     {
      i=n;
     }
          }
   }
  }
   }
 }
 for(i=0;i<n;i++)
 {
 if(finish[i]==1)
 {
  c1++;
 }
 else
 {
  printf("P%d->",i);
 }
}
if(c1==n)
{
 printf("\n The system is in safe state");
}
else
```

```
 {
  printf("\n Process are in dead lock");
  printf("\n System is in unsafe state");
 }
}
```

Output:

```
Enter the no of Processes       5
Enter the no of resources instances     3
Enter the Max Matrix
7 5 3
3 2 2
9 0 2
2 2 2
4 3 3
Enter the Allocation Matrix
0 1 0
2 0 0
3 0 2
2 1 1
0 0 2
Enter the available Resources
3 3 2
Process  Allocation      Max     Available
P1        0 1 0       7 5 3   3 3 2
P2        2 0 0       3 2 2
P3        3 0 2       9 0 2
P4        2 1 1       2 2 2
P5        0 0 2       4 3 3
P1->P3->P4->P2->P0->
 The system is in safe state
```

Result:

Thus the program to implement Bankers algorithm for deadlock avoidance has been written and executed successfully.

Ex.No:8 Implementation of Deadlock Detection Algorithm

Aim:

To write a C program to implement Deadlock Detection algorithm

Algorithm:

1. Start the Program
2. Get the values of resources and processes.
3. Get the avail value.
4. After allocation find the need value.
5. Check whether its possible to allocate.
6. If it is possible then the system is in safe state.

7.Stop the execution

Program:

```
#include<stdio.h>
int max[100][100];
int alloc[100][100];
int need[100][100];
int avail[100];
int n,r;
void input();
void show();
void cal();
int main()
{
int i,j;
  printf("********** Deadlock Detection Algorithm************\n");
  input();
  show();
cal();
   return 0;
}
void input()
{
  int i,j;
  printf("Enter the no of Processes\t");
  scanf("%d",&n);
printf("Enter the no of resource instances\t");
scanf("%d",&r);
printf("Enter the Max Matrix\n");
for(i=0;i<n;i++)
  {
   for(j=0;j<r;j++)
   {
     scanf("%d",&max[i][j]);
   }
  }
printf("Enter the Allocation Matrix\n");
```

```
for(i=0;i<n;i++)
{
    for(j=0;j<r;j++)
    {
      scanf("%d",&alloc[i][j]);
    }
  }
  printf("Enter the available Resources\n");
  for(j=0;j<r;j++)
  {
    scanf("%d",&avail[j]);
  }
}
void show()
{
int i,j;
printf("Process\t Allocation\t Max\t Available\t");
  for(i=0;i<n;i++)
  {
  printf("\nP%d\t ",i+1);
    for(j=0;j<r;j++)
    {
      printf("%d ",alloc[i][j]);
    }
    printf("\t");
    for(j=0;j<r;j++)
    {
      printf("%d ",max[i][j]);
    }
    printf("\t");
    if(i==0)
    {
      for(j=0;j<r;j++)
      printf("%d ",avail[j]);
    }
  }
}
void cal()
{
int finish[100],temp,need[100][100],flag=1,k,c1=0;
int dead[100];
  int  safe[100];
  int i,j;
  for(i=0;i<n;i++)
  {
    finish[i]=0;
  }
  for(i=0;i<n;i++)
  {
    for(j=0;j<r;j++)
```

```
        {
          need[i][j]=max[i][j]-alloc[i][j];
        }
    }
    while(flag)
    {
        flag=0;
         for(i=0;i<n;i++)
        {
          int c=0;
          for(j=0;j<r;j++)
           {
             if((finish[i]==0)&&(need[i][j]<=avail[j]))
             {
                c++;
               if(c==r)
               {
                 for(k=0;k<r;k++)
                 {
                   avail[k]+=alloc[i][j];
                   finish[i]=1;
                   flag=1;
                        }
                 if(finish[i]==1)
                 {
                   i=n;
                }
              }
             }
           }
           }
      }
      j=0;
      flag=0;
      for(i=0;i<n;i++)
      {
       if(finish[i]==0)
       {
         dead[j]=i;
         j++;
         flag=1;
       }
     }
     if(flag==1)
     {
printf("\n\nSystem is in Deadlock and the Deadlock processes are\n");
        for(i=0;i<n;i++)
        {
          printf("P%d\t",dead[i]);
        }
```

```
}
  else
  {
    printf("\nNo Deadlock Occur");
  }
}
```

Output:

```
[examuser1@linux ~]$ vi ddet.c
[examuser1@linux ~]$ cc ddet.c
[examuser1@linux ~]$ ./a.out
********** Deadlock Detection Algo ************
Enter the no of Processes       3
Enter the no of resource instances      3
Enter the Max Matrix
3 6 8
4 3 3
3 4 4
Enter the Allocation Matrix
3 3 3
2 0 3
1 2 4
Enter the available Resources
1 2 0
Process  Allocation      Max     Available
P1        3 3 3       3 6 8          1 2 0
P2        2 0 3       4 3 3
P3        1 2 4       3 4 4



System is in Deadlock and the Deadlock processes are
P0                              P1                  P2
```

Result:

Thus the program to implement deadlock detection algorithm has been written and executed successfully.

Ex.No:9 Implementation of Threading

Aim:

To write a C program to implement Threading & Synchronization

Algorithm:

1. Start the Program
2. Initialize the process thread array.
3. Print the job started status.
4. Print the job finished status.
5. Start the main function
6. Check for the process creation if not print error message.
7. Stop the execution

Program:

```
#include<stdio.h>
#include<string.h>
#include<pthread.h>
#include<stdlib.h>
#include<unistd.h>
pthread_t tid[2];
int counter;
void* doSomeThing(void *arg)
{
  unsigned long i = 0;
  counter += 1;
  printf("\n Job %d started\n", counter);
  for(i=0; i<(0xFFFFFFFF);i++);
  printf("\n Job %d finished\n", counter);
  return NULL;
}
int main(void)
{
    int i = 0;
    int err;

    while(i < 2)
    {
err = pthread_create(&(tid[i]), NULL, &doSomeThing, NULL);
 if (err != 0)
 printf("\ncan't create thread :[%s]", strerror(err));
  i++;
    }
    pthread_join(tid[0], NULL);
    pthread_join(tid[1], NULL);
    return 0;
}
```

Output:

```
$ ./tgsthreads
Job 1 started
Job 2 started
Job 2 finished
Job 2 finished
```

Result:

Thus the program to implement threading and synchronization application has been written and executed successfully.

Ex: No: 10 Implementation of Paging Technique

Aim:

To write a C program to implement paging technique.

Algorithm:

1. Start the program.
2. Get the number of pages in the process.
3. Get the size of the pages.
4. Get the page table values in frame numbers.
5. Insert the pages into the memory using the formula

   $Z=l[i/m]*m+(i/m)$
6. Display the memory allocation
7. Stop the program.

Program:

```
#include<stdio.h>
#include<conio.h>
void main(void)
{
int i,m,n,k,z,l[30];
char data[25][10],mem[50][10];
clrscr();
for(i=0;i<50;i++)
strcpy(mem[i]," ");
printf("Enter the number of pages");
scanf("%d",&n);
printf("\nEnter the page size:");
scanf("%d",&m);
k=m*n;
printf("\nEnter the %d number of data:\n",k);
for(i=0;i<k;i++)
scanf("%s",data[i]);
printf("Enter the %d page table values:\n",n);
for(i=0;i<n;i++)
scanf("%d",&l[i]);
for(i=0;i<k;i++)
{
z=l[i/m]*m+(i%m);
strcpy(mem[z],data[i]);
}
printf("\t Memory allocation");
for(i=0;i<30;i++)
printf("\t%d\t\t%s\n",i,mem[i]);
getch();
}
```

Output:

```
Enter the number of pages 4
Enter the page size 4
Enter the 16 number of data
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
enter the 4 page table values:
2
4
0
1
       memory allocation
        0              i
        1              j
        2              k
        3              l
        4              m
        5              n
        6              o
        7              p
        8              a
        9              b
        10              c
        11              d
        12
        13
        14
        15
        16              e
        17              f
        18              g
        19              h
        20
        21
```

```
22
23
24
25
26
27
28
29
```

Result:

Thus the c program to implement the paging technique has been written and executed successfully.

Ex.No:11 Implementation of the following Memory Allocation Methods for fixed partition

Aim:

To write a program to implement memory allocation method for fixed partition using first fit,worst fit,best fit algorithms.

Algorithm:

1. Start the process.
2. Declare the size.
3. Get the number of processes to be inserted.
4. For first fit
   a. Allocate the first hole that is big enough for searching.
   b. Start from the beginning set of holes.
   c. If not start at the hole, which is sharing the previous first fit search end.
   d. Compare the hole.
   e. If large enough, then stop searching in the procedure.
5. For Worst Fit

a. Allocate the **largest free hole** available in the memory that is sufficient enough to hold the process within the system.

b. Search the complete memory for available free partitions

c. Allocate the process to the memory partition which is the largest out of all.

6. For best fit
   a. Allocate the best hole that is small enough for searching.
   b. Start at the best of the set of holes.
   c. If not start at the hole, which is sharing the previous best fit search end.
   d. Compare the hole.
   e. If small enough, then stop searching in the procedure.
   f. Display the values.
7. Terminate the process.

Program:

```
#include<stdio.h>
int main()
  {
  int n,p,i,j,tmp,t;
  int size[10],first[10],best[10],worst[10];
  printf(" Memory Allocation Strategy \n\n Enter the number of holes in the Main Memory
: ");
  scanf("%d",&n);
  printf(" Mention their sizes.\n");
  for (i=0;i<n;i++)
```

```
    {
    printf("Hole %d : ",i+1);
    scanf("%d",&size[i]);
    }
  printf(" Holes and their sizes \n\n");
  for (i=0;i<n;i++)
    {
    printf(" Hole %d : %d\n",i+1,size[i]);
    first[i]=size[i];
    best[i]=size[i];
    worst[i]=size[i];
    }
  printf("Enter the size of new process : ");
  scanf("%d",&p);
  printf("\n FIRST - FIT \n *********** \n");
  for (i=0;i<n;i++)
    {
    if (size[i]>=p)
     {
     first[i]=size[i]-p;
     break;
     }
    }
    if (n==i+1)
     {
     printf("...... New process of size %d cannot be stored in any holes",p);
     goto l;
     }
    for (i=0;i<n;i++)
      {
      printf("\tHole %d : %d\n",i+1,first[i]);
      }
l:printf("\n BEST - FIT \n *********** \n");
   t=0;
  for (i=0;i<n;i++)
  best[i]=size[i]-p;
  tmp=best[0];
  for (i=1;i<n;i++)
    {
    if (best[i]>0)
     {
     if (best[i]<tmp)
      {
      tmp=best[i];
      t=i;
      }
     }
    }
  for (i=0;i<n;i++)
    best[i]=size[i];
  if (best[t]>=p)
  best[t]=best[t]-p;
  else
     {
     printf("...... New process of size %d cannot be stored in any holes.",p);
     goto l1;
     }
     for (i=0;i<n;i++)
      printf("\tHole %d : %d\n",i+1,best[i]);
l1: printf("\n WORST - FIT \n *********** \n");
   t=0;
  for (i=0;i<n;i++)
  best[i]=size[i]-p;
  tmp=best[0];
  for (i=1;i<n;i++)
    {
    if (best[i]>0)
     {
     if (best[i]>tmp)
      {
      tmp=best[i];
      t=i;
      }
     }
    }
  for  (i=0;i<n;i++)
  worst[i]=size[i];
  if (worst[t]>=p)
   worst[t]=worst[t]-p;
  else
     {
     printf("...... New process of size %d cannot be stored in any holes.",p);
     goto l2;
     }
  for (i=0;i<n;i++)
      printf("\tHole %d : %d\n",i+1,worst[i]);
l2: printf("\nProgram Ended");
}
```

Output:

```
[examuser1@linux ~]$ vi fit.c
[examuser1@linux ~]$ cc fit.c
[examuser1@linux ~]$./a.out
Memory Allocation Strategy

 Enter the number of holes in the Main Memory : 3
 Mention their sizes.
Hole 1 : 100
Hole 2 : 50
Hole 3 : 150
 Holes and their sizes

 Hole 1 : 100
 Hole 2 : 50
 Hole 3 : 150
Enter the size of new process : 40

 FIRST - FIT
 ***********
        Hole 1 : 60
        Hole 2 : 50
        Hole 3 : 150

 BEST - FIT
 ***********
        Hole 1 : 100
        Hole 2 : 10
        Hole 3 : 150

 WORST - FIT
 ***********
        Hole 1 : 100
        Hole 2 : 50
        Hole 3 : 110

Program Ended
```

Result:

Thus the c program to implement memory allocation methods for fixed partitions has been written and executed successfully.

Ex: No: 12a Implementation Of FIFO Page Replacement Algorithm

Aim:

To write a program to implement FIFO page replacement algorithm.

Algorithm:

1. Start the process.
2. Declare the size with respect to page length.
3. Check the need of replacement from page to memory.
4. Check the need of replacement from old page to new page in memory.
5. Form a queue to hold all pages.
6. Insert the page memory into the queue.
7. Check for bad replacement and page faults.
8. Get the number of process to be inserted.
9. Display the values.
10. Stop the process.

Program:

```
#include<stdio.h>
#include<conio.h>
void main()
{
int n,ref[50],f,frame[10],i,fault=0,k=0,j;
clrscr();
printf("\n Enter the number of reference string:");
scanf("%d",&n);
printf("\n Enter the reference string values");
for(i=0;i<n;i++)
scanf("%d",&ref[i]);
printf("\n Enter the frame size:");
scanf("%d",&f);
printf("\n FIFO page replacement \n");
for(i=0;i<f;i++)
{
frame[i]=ref[i];
printf("%d\t",frame[i]);
}
fault=f;
while(i<n)
{
for(j=0;j<f;j++)
{
if(ref[i]==frame[j])
{
break;
}
}
if(f==j)
{
fault++;
frame[k]=ref[i];
k++;
if(k==3)
k=0;
printf("\n");
for(j=0;j<f;j++)
printf("%d\t",frame[j]);
}
i++;
}
printf("\n Number of page fault is %d",fault);
getch();
}
```

Output:

```
Enter the number of reference string:6

 Enter the reference string values2
3
4
5
6
7

 Enter the frame size:3

 FIFO page replacement
2       3       4
5       3       4
5       6       4
5       6       7
 Number of page fault is 6
```

Result:

Thus the c program to implement FIFO page replacement has been written and executed successfully.

Ex: No: 12b Implementation Of LRU Page Replacement Algorithm

Aim:

To write a program to implement LRU page replacement

Algorithm:

1. Start the process.
2. Declare the size.
3. Get the number of pages to be inserted.
4. Get the value.
5. Declare the counter and stack value.
6. Select the least recently used by counter value.
7. Stack them according to the selection
8. Display the values.
9. Stop the process.

Program:

```
#include<stdio.h>
#include<conio.h>
int main()
{
int q[20],p[50],c=0,c1,d,f,i,j,k=0,n,r,t,b[20],c2[20];
clrscr();
printf("Enter the number of pages:");
scanf("%d",&n);
printf("Enter the references string");
for(i=0;i<n;i++)
scanf("%d",&p[i]);
printf("Enter the no of frames:");
scanf("%d",&f);
q[k]=p[k];
printf("\n\t%d\n",q[k]);
c++;
k++;
for(i=1;i<n;i++)
{
c1=0;
for(j=0;j<f;j++)
{
if(p[i]!=q[j])
c1++;
}
if(c1==f)
{
c++;
if(k<f)
{
q[k]=p[i];
k++;
for(j=0;j<k;j++)
printf("\t%d",q[j]);
printf("\n");
}
else
{
for(r=0;r<f;r++)
{
c2[r]=0;
for(j=i-1;j<n;j--)
{
if(q[r]!=p[j])
c2[r]++;

else
break;
}
}
for(r=0;r<f;r++)
b[r]=c2[r];
for(r=0;r<f;r++)
{
for(j=r;j<f;j++)
{
if(b[r]<b[j])
{
t=b[r];
b[r]=b[j];
b[j]=t;
}
}
}
for(r=0;r<f;r++)
{
if(c2[r]==b[0])
q[r]=p[i];
printf("\t%d",q[r]);
}
printf("\n");
}
}
}
printf("\n The no. of page faults is %d",c);
return 0;
}
```

Output:

```
Enter the number of pages:18
Enter the references string
7
0
1
2
0
3
0
4
2
3
0
3
2
1
2
0
1
7
Enter the no of frames:4

        7
        7       0
        7       0       1
        7       0       1       2
        3       0       1       2
        3       0       4       2
        3       0       1       2
        7       0       1       2

 The no. of page faults is 8
```

Result:

Thus the c program to implement LRU page replacement has been written and executed successfully.

Ex. No: 12c Optimal (LFU) Page Replacement Algorithm

Aim:

To write a program to implement LFU page replacement.

Algorithm:

1. Start the process.
2. Declare the size.
3. Get the number of pages to be inserted.
4. Get the value.
5. Declare the counter and stack value.
6. Select the least frequently used by counter value.
7. Stack them according to the selection
8. Display the values.
9. Stop the process.

Program:

```
#include<stdio.h>
#include<conio.h>
int i,j,nof,nor,flag=0,ref[50],frm[50],pf=0,victim=-1;
int recent[10],optcal[50],count=0;
int optvictim();
void main()
{
  clrscr();
  printf("\n OPTIMAL PAGE REPLACEMENT ALGORITHN");
  printf("\n................................ ");
  printf("\nEnter the no.of frames");
  scanf("%d",&nof);
  printf("Enter the no.of reference string");
  scanf("%d",&nor);
  printf("Enter the reference string");
  for(i=0;i<nor;i++)
     scanf("%d",&ref[i]);
  clrscr();
  printf("\n OPTIMAL PAGE REPLACEMENT ALGORITHM");
  printf("\n.............................. ");
  printf("\nThe given string");
  printf("\n....................\n");
  for(i=0;i<nor;i++)
     printf("%4d",ref[i]);
  for(i=0;i<nof;i++)
  {
     frm[i]=-1;
     optcal[i]=0;
  }
  for(i=0;i<10;i++)
```

```
        recent[i]=0;
    printf("\n");
    for(i=0;i<nor;i++)
    {
      flag=0;
      printf("\n\tref no %d ->\t",ref[i]);
      for(j=0;j<nof;j++)
      {
                          if(frm[j]==ref[i])
                          {
                            flag=1;
                            break;
                          }
      }
      if(flag==0)
      {
                          count++;
                          if(count<=nof)
                             victim++;
                          else
                             victim=optvictim(i);
                          pf++;
                          frm[victim]=ref[i];
                          for(j=0;j<nof;j++)
                            printf("%4d",frm[j]);
      }
    }
    printf("\n Number of page faults: %d",pf);
    getch();
  }
  int optvictim(int index)
  {
    int i,j,temp,notfound;
    for(i=0;i<nof;i++)
    {
      notfound=1;
      for(j=index;j<nor;j++)
                          if(frm[i]==ref[j])
                          {
                             notfound=0;
                             optcal[i]=j;
                             break;
                          }
      if(notfound==1)
                            return i;
    }
    temp=optcal[0];
    for(i=1;i<nof;i++)
       if(temp<optcal[i])
                            temp=optcal[i];
```

```
   for(i=0;i<nof;i++)
       if(frm[temp]==frm[i])
                               return i;
 return 0;
}
```

Output:

```
                        OPTIMAL PAGE REPLACEMENT ALGORITHM

Enter no.of Frames…. 3
 Enter no.of reference string. 6

 Enter reference string..
6 5 4 2 3 1


               OPTIMAL PAGE REPLACEMENT ALGORITHM
          The given reference string:
           …………………. 6   5   4   2   3   1

          Reference NO 6->          6  -1  -1
          Reference NO 5->          6   5  -1
          Reference NO 4->          6   5   4
          Reference NO 2->          2   5   4
          Reference NO 3->          2   3   4
          Reference NO 1->          2   3   1

          No.of page faults...6
```

Result:

Thus the c program to implement Optimal (LFU) page replacement has been written and executed successfully.

Ex.No: 13 a Single Level Directory

Aim:

To write a C program to implement File Organization concept using the technique Single level directory.

Algorithm:

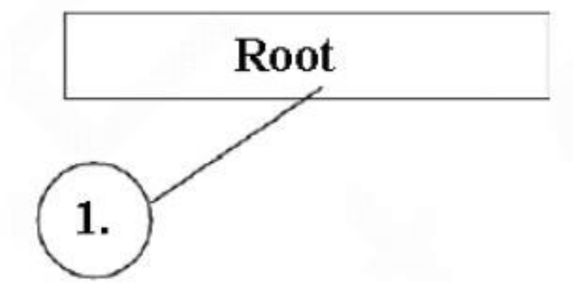
1. Start the Program
2. Initialize values gd=DETECT,gm,count,i,j,mid,cir_x.
3. Initialize graph function
4. Set back ground color with setbkcolor();
5. Read number of files in variable count.
6. Check i<count; mid=640/count;
7. Stop the execution

Program:

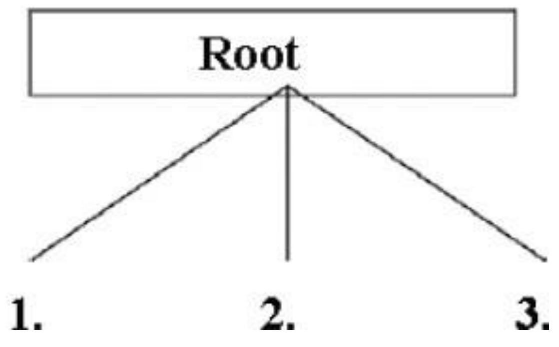
```
#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#include<graphics.h>
void main()
{
   int gd=DETECT, gm, count, i, j, mid, cir_x;
char fname[10][20];
clrscr();
initgraph(&gd, &gm, "c:\c\bgi");
cleardevice();
setbkcolor(GREEN);
puts("Enter no. of Files fo you have?");
scanf("%d", &count);

for(i=00;i<count;i++)
{
   cleardevice();
setbkcolor(GREEN);
printf("Enter File %d Name", i+1);
scanf("%s", fname[i]);
setfillstyle(1,MAGENTA);
mid = 640 / count;

cir_x=mid/3;
bar3d(270,100,370,150,0,0);
settextstyle(2,0,4);
settextjustify(1,1);
outtextxy(320,125,"Root Directory");
setcolor(BLUE);
for(j=0;j<=i;j++,cir_x+=mid)
{
    line(320,150,cir_x,250);
    fillellipse(cir_x,250,30,30);
    outtextxy(cir_x,250,fname[j]);
}
getch();
}
}
```

Output:

```
Enter no. of Files do you have?  3
Enter file1 name :  1.c
```



```
Enter file3 name :  3.c
```



Result:

Thus the C program to implement File Organization concept using the technique Single level directory has been written and executed successfully.

Ex.No: 13 b **Two Level Directoryies**

Aim:

To write a C program to implement File Organization concept using the technique two level directories.

Algorithm:

1. Start the Program
2. Initialize structure elements
3. Start main function
4. Set variables gd =DETECT, gm;
5. Create structure using create (&root,0,"null",0,639,320);
6. initgraph(&gd,&gm,"c:\tc\bgi");
7. Stop the execution

Program:

```
#include<stdio.h>
#include<graphics.h>
struct tree_element
{
   char name[20];
   int x,y,ftype,lx,rx,nc,level;
   struct tree_element *link[5];
};
typedef struct tree_element node;
void main()
{
   int gd=DETECT,gm;
node *root;
root=NULL;
clrscr();
create(&root,0,"null",0,639,320);
clrscr();
initgraph(&gd,&gm,"c:\\tc\\bgi");
display(root);
getch();
closegraph();
}
create(node **root, int lev, char *dname,
                              int lx,int rx,int x)
{
   int i,gap;
   if(*root==NULL)
{
 (*root)=(node*)malloc(sizeof(node));
  printf("Enter Name of Dir/File under %s):",dname);
  fflush(stdin);
  gets((*root)->name);
 if(lev==0||lev==1)
 (*root)->ftype=1;
 else
 (*root)->ftype=2;
(*root)->level=lev;
(*root)->y=50+lev*50;
(*root)->x=x;
(*root)->lx=lx;
(*root)->rx=rx;
for(i=0;i<5;i++)
  (*root)->link[i]=NULL;
  if((*root)->ftype==1)
    {
if(lev==0||lev==1)
{
  if((*root)->level==0)
printf("How many Users :");
    else
printf("How many Files :");
printf("(for%s):", (*root)->name);
scanf("%d",& (*root)->nc);
}else(*root)->nc=0;
if((*root)->nc==0)
gap=rx-lx;
else
   gap=(rx-lx)/(*root)->nc;
for(i=0;i<(*root)->nc;i++)
create(&((*root)->link[i]),lev+1,
(*root)->name,lx+gap*i,lx+gap*i+gap,lx+gap*i+gap/2);
}
else (*root)->nc=0;
    }
}
display(node *root)
{
    int i;
    settextstyle(2,0,4);
    settextjustify(1,1);
    setfillstyle(1,BLUE);
    setcolor(14);
    if(root!=NULL)
    {
for(i=0;i<root->nc;i++)
{
  line(root->x,root->y,root->link[i]->x,root->link[i]->y);
}
if(root->ftype==1)
bar3d(root->x-20, root->y-10,root->x+20,root->y+10,0,0);
else
 fillellipse(root->x,root->y,20,20);
 outtextxy(root->x,root->y,root->name);
 for(i=0;i<root->nc;i++)
 {
```

```
display(root->link[i]);
   } }
   }
```

Output:

```
Enter Name of Dir/File (under null) : sld
How many Users (for sld) : 2
Enter Name of Dir/File (under sld) : tld
How many Files (for tld) : 2
Enter Name of Dir/File (under tld) : hir
Enter Name of Dir/File (under tld) : dag
Enter Name of Dir/File (under sld) : bin
How many Files (for bin) : 2
Enter Name of Dir/File (under bin) : exe
Enter Name of Dir/File (under bin) : obj
```

Result:

Thus the C program to implement File Organization concept using the technique two level directories has been written and executed successfully.

Ex.No: 13 c **Hierarchical Directories**

Aim:

To write a C program to implement File Organization concept using the technique hierarchical level directories.

Algorithm:

1. Start the Program
2. Define structure and declare structure variables
3. In main declare variables
4. Check a directory tree structure
5. Display the directory tree in graphical mode.
6. Stop the execution

Program:

```
#include<stdio.h>
#include<graphics.h>
struct tree_element
{
  char name[20];
  int x,y,ftype,lx,rx,nc,level;
  struct tree_element *link[5];
};
typedef struct tree_element node;
void main()
{
  int gd=DETECT,gm;
  node *root;
  root=NULL;
  clrscr();
  create(&root,0,"root",0,639,320);
  clrscr();
  initgraph(&gd,&gm,"c:\\tc\\BGI");
  display(root);
  getch();
  closegraph();
}
create(node **root,int lev, char *dname,
int lx,int rx,int x)
{
   int i,gap;
   if(*root==NULL)
{
(*root)=(node *)malloc(sizeof(node));
printf("Enter Name of Dir/File (under %s) : ",dname);
fflush(stdin);
gets((*root)->name);
printf("Enter 1 for Dir/2 for File :");
scanf("%d",&(*root)->ftype);
(*root)->level=lev;
(*root)->y=50+lev*50;
(*root)->x=x;
(*root)->lx=lx;
(*root)->rx=rx;
for(i=0;i<5;i++)
 (*root)->link[i]=NULL;
if((*root)->ftype== 1)
{
    printf("No. of Sub Directories / Files (for %s) :",
                                (*root)->name);
    scanf("%d",&(*root)->nc);
    if((*root)->nc==0)
   gap=rx-lx;
    else
  gap=(rx-lx)/(*root)->nc;
    for(i=0;i<(*root)->nc;i++)
create(&((*root)->link[i]),lev+1,(*root)->name,
   lx+gap*i,lx+gap*i+gap,lx+gap*i+gap/2);
    }
    else(*root)->nc=0;
    }
    }
    display(node *root)
    {
int i;
settextstyle(2,0,4);
settextjustify(1,1);
setfillstyle(1,BLUE);
setcolor(14);
if(root!=NULL)
{
for(i=0;i<root->nc;i++)
{
line(root->x,root->y,root->link[i]->x,root->link[i]->y);
    }
 if(root->ftype==1)
bar3d(root->x-20, root->y-10,root->x+20,root->y+10,0,0);
   else
fillellipse(root->x, root->y,20,20);
outtextxy(root->x, root->y, root->name);
   for(i=0;i<root->nc;i++)
    {
display(root->link[i]);
    }
                                  }
    }
```

Output:

```
Enter Name of Dir/File (under root) : ROOT
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for ROOT) :2
Enter Name of Dir/File (under ROOT) : USER 1
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for USER 1) :1
Enter Name of Dir/File (under USER 1) : SUBDIR
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for SUBDIR) :2
Enter Name of Dir/File (under SUBDIR) : JAVA
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for JAVA) :0
Enter Name of Dir/File (under SUBDIR) : VB
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for VB) :0
Enter Name of Dir/File (under ROOT) : USER 2
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for USER 2) :2
Enter Name of Dir/File (under USER 2) : SUBDIR 2
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for SUBDIR 2) :2
Enter Name of Dir/File (under SUBDIR 2) : PPL
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for PPL) :2
Enter Name of Dir/File (under PPL) : B
Enter 1 for Dir/2 for File :2
Enter Name of Dir/File (under PPL) : C
Enter 1 for Dir/2 for File :2
Enter Name of Dir/File (under SUBDIR 2) : AI
Enter 1 for Dir/2 for File :1
No. of Sub Directories / Files (for AI) :2
Enter Name of Dir/File (under AI) : D
Enter 1 for Dir/2 for File :2
Enter Name of Dir/File (under AI) : E
Enter 1 for Dir/2 for File :2
```

Result:

Thus the C program to implement File Organization concept using the technique hierarchical level directory has been written and executed successfully.

Ex.No: 13 d Directed Acyclic Graph Directory

Aim:

To write a C program to implement File Organization concept using the technique directed acyclic graph directory.

Algorithm:

1. Start the Program
2. Define structure and declare structure variables
3. In main declare variables
4. Check a directory tree structure
5. Display the directory tree in graphical mode
6. Stop.

Program:

```
#include<stdio.h>
#include<conio.h>
#include<graphics.h>
#include<string.h>
struct tree_element
{
   char name[20];
   int x,y,ftype,lx,rx,nc,level;
   struct tree_element *link[5];
};
typedef struct tree_element node;
typedef struct
{
   char from[20];
   char to[20];
}link;
link L[10]; int nofl;
node *root;
void main()
{
   int gd=DETECT, gm;
   root=NULL;
clrscr();
create(&root,0,"root",0,639,320);
read_links();
clrscr();
initgraph(&gd,&gm,"c:\\tc\\BGI");
draw_link_lines();
display(root);
getch();
closegraph();
}
read_links()
{
   int i;
   printf("How many Links :");
   scanf("%d",&nofl);
   for(i=0;i<nofl;i++)
   {
                       printf("File / Dir :");
                       fflush(stdin);
                       gets(L[i].from);
                       printf("Username :");
                       fflush(stdin);
                       gets(L[i].to);
   }
}
draw_link_lines()
{
   int i,x1,y1,x2,y2;
   for(i=0;i<nofl;i++)
   {
                       search(root,L[i].from,&x1,&y1);
                       search(root,L[i].to,&x1,&y1);
                       setcolor(LIGHTGREEN);
                       setlinestyle(3,0,1);
                       line(x1,y1,x2,y2);
                       setcolor(YELLOW);
                       setlinestyle(0,0,1);
   }
}
search(node *root,char *s,int *x,int *y)
{
   int i;
   if(root!=NULL)
  {
                       if(strcmpi(root->name,s)==0)
{    *x=root->x;
   *y=root->y;
   return;
}
else
{
   for(i=0;i<root->nc;i++)
                       search(root->link[i],s,x,y);
}
   }
}
create(node **root,int lev,char *dname,int lx,
                       int rx,int x)
{
   int i,gap;
   if(*root==NULL)
   {
(*root)=(node *)malloc(sizeof(node));
printf("Enter Name of Dir / File (under %s):",dname);
fflush(stdin);
gets((*root)->name);
printf("Enter 1 for Dir / 2 for File :");
scanf("%d",&(*root)->ftype);
(*root)->level=lev;
(*root)->y=50+lev*50;
(*root)->x=x;
(*root)->lx=lx;
(*root)->rx=rx;
for(i=0;i<5;i++)
(*root)->link[i]=NULL;
if((*root)->ftype==1)
{
printf("No. of Sub-Directories / Files (for %s) :",
(*root)->name);
 scanf("%d",&(*root)->nc);
if((*root)->nc==0)
gap=rx-lx;
else
gap=(rx-lx)/(*root)->nc;
for(i=0;i<(*root)->nc;i++)
create(&((*root)->link[i]), lev+1,
 (*root)->name,lx+gap*i,lx+gap*i+gap,lx+gap*i+gap/2);
                              }
                              else
                              *root)->nc=0;
    }
}
/* Displays the Constructed Tree in Grpahics mode */
display(node *root)
{
    int i;
    settextstyle(2,0,4);
    settextjustify(1,1);
    setfillstyle(1,BLUE);
    setcolor(14);
    if(root!=NULL)
    {
for(i=0;i<root->nc;i++)
{
   line(root->x,root->y,root->link[i]->x,
root->link[i]->y);
}
if(root->ftype==1)
    bar3d(root->x-20, root->y-10, root->x+20,
 root->y+10,0,0);
else
    fillellipse(root->x, root->y, 20, 20);
    outtextxy(root->x, root->y, root->name);
    for(i=0;i<root->nc;i++)
    {
                    display(root->link[i]);
    }
}
}
```

Output :

```
Enter Name of Dir/File (under root) : ROOT
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for ROOT) : 2
Enter Name of Dir/File (under ROOT) : USER 1
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for USER 1) : 2
Enter Name of Dir/File (under USER 1) : VB
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for VB) : 2
Enter Name of Dir/File (under VB) : A
Enter 1 for Dir / 2 for File : 2
Enter Name of Dir/File (under VB) : B
Enter 1 for Dir / 2 for File : 2
Enter Name of Dir/File (under USER 1) : C
Enter 1 for Dir / 2 for File : 2
Enter Name of Dir/File (under ROOT) : USER 2
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for USER2) : 1
Enter Name of Dir/File (under USER 2) : JAVA
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for JAVA) : 2

Enter Name of Dir/File (under JAVA) : D
Enter 1 for Dir / 2 for File : 2
Enter Name of Dir/File (under JAVA) : HTML
Enter 1 for Dir / 2 for File : 1
No. of Sub-Directories / Files (for JAVA) : 0
How many Links : 2
File/Dir : B
User Name : USER 2
File/Dir : HTML
User Name : USER 1
```

Result:

Thus the C program to implement File Organization concept using directed acyclic graph directory has been written and executed successfully.

Ex.No.14a Sequential File Allocation

Aim:

To implement sequential file allocation technique.

Algorithm:

```
1.Start the program.
2.Get the number of files.
3.Get the memory requirement of each file.
4.Allocate the required locations to each in sequential order.
    4.1.Randomly select a location from available location s1= random(100);
    4.2.Check whether the required locations are free from the selected location.
    4.3.Allocate and set flag=1 to the allocated locations.
5.Print the results file number, length , Blocks allocated.
6.Stop the program.
```

Program:

```
#include<stdio.h>
int main()
{
int f[50],i,st,j,len,c,k,count=0;
for(i=0;i<50;i++)
f[i]=0; X:
printf("\n enter starting block & length of files");
scanf("%d%d",&st,&len);
printf("\n file not allocated(yes-1/no-0)");
for(k=st;k<(st+len);k++)
if(f[k]==0)
count++;
if(len==count)
{
for(j=st;j<(st+len);j++)
if(f[i]==0)
{
f[j]=1;
printf("\n%d\t%d",j,f[j]);
if(j==(st+len-1))
printf("\n the file is allocated to disk");
}
}
else
printf("file is not allocated");
count=0;
printf("\n if u want to enter more files(y-1/n-0)");
scanf("%d",&c);
if(c==1)
goto X;
else
exit(0);
return 0;
}
```
Output:

```
[examuser1@linux ~]$ cc sequential.c

[examuser1@linux ~]$ ./a.out

enter starting block & length of files3
5

file not allocated(yes-1/no-0)
3       1
4       1
5       1
6       1
7       1

the file is allocated to disk
if u want to enter more files(y-1/n-0)1

enter starting block & length of files0
3

file not allocated(yes-1/no-0)
0       1
1       1
2       1

the file is allocated to disk
if u want to enter more files(y-1/n-0)1

enter starting block & length of files5
3

file not allocated(yes-1/no-0)file is not allocated
if u want to enter more files(y-1/n-0)1

enter starting block & length of files8
3

file not allocated(yes-1/no-0)
8       1
9       1
10      1

the file is allocated to disk
if u want to enter more files(y-1/n-0)0
```

Result:

Thus the C program to implement sequential file allocation has been written and executed successfully.

Ex.No: 14 b **Indexed File Allocation Strategy**

Aim:

To write a C program to implement File Allocation concept using indexed allocation Technique.

Algorithm:

1. Start the Program
2. Get the number of files.
3. Get the memory requirement of each file.
4. Allocate the required locations by selecting a location randomly.
5. Print the results file no,length, blocks allocated.
6. Stop the execution.

Program:

```
#include<stdio.h>
#include<conio.h>
#include<string.h>
struct file
{
char n[20];
int ind;
}s[20];
int no,i= -1,a,b,f,j= -1,fe,t;
char tem[20];
void create();
void display();
void del();
void main()
{
clrscr();
while(1)
{
printf("\n \n Menu" );
printf("\n 1.Create \n 2.Display \n 3.Delete \n 4.Exit ");
printf("Enter Your Choice : ");
scanf("%d",&no);
switch(no)
{
case 1:
create();
break;
case 2 :
display();
break;
case 3:
del();
break;
case 4:
exit(0);
default :
```

```
printf("Wrong Choice");
}
}
}
void create()
{
i++;
printf("\n Enter the name of the record : ");
scanf("%s",&s[i].n);
printf("\n Enter the Index no. :");
scanf("%d",&s[i].ind);
j++;
}
void display()
{
for(a=0;a<i;a++)
{
for(b=0;b<i;b++)
{
if(s[b].ind > s[b+1].ind)
{
t = s[b].ind;
s[b].ind = s[b+1].ind;
s[b+1].ind = t;
strcpy(tem,s[b].n);
strcpy(s[b].n,s[b+1].n);
strcpy(s[b+1].n,tem);
                         }
else
continue;
}
}
printf("\n \t  Index     Recordname");
for(i=0;i<=j;i++)
{
printf("\n \t %d \t",s[i].ind);
printf("\t %s",s[i].n);
 }
i--;
}
 void del()
{
int de,index= -1, k=0,l;
if(i!= -1)
{
printf("Enter Index no. to be Deleted : ");
scanf("%d", &de);
index = de;
while(s[k].ind!= de)
{
```

```
k++;
printf("\n \t \t \t %d",k);
}
for(l=k;l<=j;l++)
s[l] = s[l+1];
i--;
j--;
printf("\n Index no. %d File is deleted",index);
 }
}
```

Output :

```
Menu
1.Create
2.Display
3.Delete
4.Exit

Enter Your Choice : 1
Enter the name of the record : a.java
Enter the index no : 0
Enter the Field no : 1

Menu
1.Create
2.Display
3.Delete
4.Exit
Enter your Choice : 1
Enter the name of the record : b.c
Enter the index no : 1
Enter the Field no : 2

Menu
1.Create
2.Display
3.Delete
4.Exit
Enter your choice : 2
------------------------
Index               Recordname          FieldNo
0                   a.java              1
1                   b.c        2
------------------------
Menu
1.Create
2.Display
3.Delete
```

```
4.Exit
Enter your Choice : 4
```

Result:

Thus the C program to implement indexed file allocation has been written and executed successfully.

Ex.No.: 14c Linked File Allocation Strategy

Aim:

To write a C program to implement File Allocation concept using Linked List Technique.

Algorithm:

1. Start the Program
2. Get the number of files.
3. Allocate the required locations by selecting a location randomly
4. Check whether the selected location is free.
5. If the location is free allocate and set flag =1 to the allocated locations.
6. Print the results file no, length, blocks allocated.
7. Stop the execution

Program:

```
#include<stdio.h>
#include<conio.h>
void main()
{
int f[50],p,i,j,k,a,st,len,n;
char c;
for(i=0;i<50;i++)
f[i]=0;
printf("enter how many blocks already allocated");
scanf("%d",&p);
printf("\nenter the blocks nos");
for(i=0;i<p;i++)
 {
scanf("%d",&a);
f[a]=1;
 }
printf("enter index starting block & length");
scanf("%d%d",&st,&len);
k=len;
if(f[st]==0)
 {
for(j=st;j<(k+st);j++)
 {
if(f[j]==0)
 {
f[j]=1;
printf("\n%d->%d",j,f[j]);
 }
else
 {
printf("\n %d->file is already allocated",j);
k++;
 }
 }
 }
else
printf("\nif u enter one more (yes-1/no-0)");
scanf("%d",&c);
if(c==1)
goto X;
else
exit();
getch();
}
```

Output:

```
enter how many blocks already allocated4

enter the blocks nos4
8
2
7
enter index sarting block & length1
10

1->1
 2->file is already allocated
3->1
 4->file is already allocated
5->1
6->1
 7->file is already allocated
8->file is already allocated
9->1
10->1
11->1
12->1
13->1
14->1
```

Result:

Thus the C program to implement linked file allocation has been written and executed successfully.

Ex.No.: 15 Implementation of various Disk Scheduling Algorithms

Ex.No.: 15a FCFS Disk Scheduling

Aim:

To write a C program to implement FCFS disk scheduling.

Algorithm:

1. Let Request array represents an array storing indexes of tracks that have been requested inascending order of their time of arrival. ‘head’ is the position of disk head.
2. Let us one by one take the tracks in default order and calculate the absolute distance of thetrack from the head.
3. Increment the total seeks count with this distance.
4. Currently serviced track position now becomes the new head position.
5. Go to step 2 until all tracks in request array have not been serviced.

Program:

```
#include<stdio.h>
#include<stdlib.h>
intmain()
{
intRQ[100],i,n,TotalHeadMoment=0,initial;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
for(i=0;i<n;i++)
scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);

// logic for FCFS disk scheduling

for(i=0;i<n;i++)
{
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
      initial=RQ[i];
}

printf("Total head moment is %d",TotalHeadMoment);
return0;

}
```

Output:

```
Enter the number of Request
8
Enter the Requests Sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Total head movement is 644
```

Result:

Thus the C program to implement FCFS disk scheduling has been written and executed successfully.

Ex.No.: 15b **SSTF Disk Scheduling**

Aim:

To write a C program to implement SSTF disk scheduling.

Algorithm:

1. Let Request array represents an array storing indexes of tracks that have been requested,‘head’ is the position of disk head.
2. Find the positive distance of all tracks in the request array from head.
3. Find a track from requested array which has not been accessed/serviced yet and has minimum distance from head.
4. Increment the total seek count with this distance.
5. Currently serviced track position now becomes the new head position.
6. Go to step 2 until all tracks in request array have not been serviced.

Program:

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,n,TotalHeadMoment=0,initial,count=0;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);

   // logic for sstf disk scheduling

      /* loop will execute until all process is completed*/
   while(count!=n)
   {
      int min=1000,d,index;
      for(i=0;i<n;i++)
      {
        d=abs(RQ[i]-initial);
        if(min>d)
        {
           min=d;
           index=i;
        }

      }
TotalHeadMoment=TotalHeadMoment+min;
```

```
        initial=RQ[index];
        // 1000 is for max
        // you can use any number
RQ[index]=1000;
        count++;
    }

printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

Output:

```
            Enter the number of Request
            8
            Enter Request Sequence
            95 180 34 119 11 123 62 64
            Enter initial head Position
            50
            Total head movement is 236
```

Result:

Thus the C program to implement SSTF disk scheduling has been written and executed successfully

Ex.No.: 15c SCAN Disk Scheduling

Aim:

To write a C program to implement SCAN disk scheduling.

Algorithm:

1. Let Request array represents an array storing indexes of tracks that have been requested in ascending order of their time of arrival. ‘head’ is the position of disk head.
2. Let direction represents whether the head is moving towards left or right.
3. In the direction in which head is moving service all tracks one by one.
4. Calculate the absolute distance of the track from the head.
5. Increment the total seek count with this distance.
6. Currently serviced track position now becomes the new head position.
7. Go to step 3 until we reach at one of the ends of the disk.
8. If we reach at the end of the disk reverse the direction and go to step 2 until all tracks in request array have not been serviced.

Program:

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);
printf("Enter total disk size\n");
scanf("%d",&size);
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

   // logic for Scan disk scheduling

      /*logic for sort the request array */
   for(i=0;i<n;i++)
   {
      for(j=0;j<n-i-1;j++)
      {
if(RQ[j]>RQ[j+1])
         {
            int temp;
            temp=RQ[j];
            RQ[j]=RQ[j+1];
            RQ[j+1]=temp;
         }

      }
```

```
    }

    int index;
    for(i=0;i<n;i++)
    {
        if(initial<RQ[i])
        {
            index=i;
            break;
        }
    }

    // if movement is towards high value
    if(move==1)
    {
        for(i=index;i<n;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }
        // last movement for max size
TotalHeadMoment=TotalHeadMoment+abs(size-RQ[i-1]-1);
        initial = size-1;
        for(i=index-1;i>=0;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
             initial=RQ[i];

        }
    }
    // if movement is towards low value
    else
    {
        for(i=index-1;i>=0;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }
        // last movement for min size
TotalHeadMoment=TotalHeadMoment+abs(RQ[i+1]-0);
        initial =0;
        for(i=index;i<n;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
             initial=RQ[i];

        }
    }

printf("Total head movement is %d",TotalHeadMoment);
```

```
    return 0;
}
```

Output:

```
Enter the number of Request
8
Enter the Requests Sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Enter total disk size
200
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 337
```

Result:

Thus the C program to implement SCAN disk scheduling has been written and executed successfully

Ex.No.: 15d **CSCAN Disk Scheduling**

Aim:

To write a C program to implement CSCAN disk scheduling.

Algorithm:

1. Let Request array represents an array storing indexes of tracks that have been requested in ascending order of their time of arrival. 'head' is the position of disk head.
2. The head services only in the right direction from 0 to the size of the disk.
3. While moving in the left direction does not service any of the tracks.
4. When we reach the beginning (left end) reverse the direction.
5. While moving in the right direction it services all tracks one by one.
6. While moving in the right direction calculates the absolute distance of the track from the head.
7. Increment the total seeks count with this distance.
8. Currently serviced track position now becomes the new head position.
9. Go to step 6 until we reach the right end of the disk.
10. If we reach the right end of the disk reverse the direction and go to step 3 until all tracks in the request array have not been serviced.

Program:

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);
printf("Enter total disk size\n");
scanf("%d",&size);
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

   // logic for C-Scan disk scheduling

      /*logic for sort the request array */
   for(i=0;i<n;i++)
   {
for( j=0;j<n-i-1;j++)
      {
if(RQ[j]>RQ[j+1])
         {
            int temp;
            temp=RQ[j];
            RQ[j]=RQ[j+1];
            RQ[j+1]=temp;
         }
```

```
        }
    }

    int index;
    for(i=0;i<n;i++)
    {
        if(initial<RQ[i])
        {
            index=i;
            break;
        }
    }

    // if movement is towards high value
    if(move==1)
    {
        for(i=index;i<n;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }
        // last movement for max size
TotalHeadMoment=TotalHeadMoment+abs(size-RQ[i-1]-1);
        /*movement max to min disk */
TotalHeadMoment=TotalHeadMoment+abs(size-1-0);
        initial=0;
for( i=0;i<index;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
             initial=RQ[i];

        }
    }
    // if movement is towards low value
    else
    {
        for(i=index-1;i>=0;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }
        // last movement for min size
TotalHeadMoment=TotalHeadMoment+abs(RQ[i+1]-0);
        /*movement min to max disk */
TotalHeadMoment=TotalHeadMoment+abs(size-1-0);
        initial =size-1;
        for(i=n-1;i>=index;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
             initial=RQ[i];
        }
    }

printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

Output:

```
Enter the number of Request
8
Enter the Requests Sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Enter total disk size
200
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 382
```

Result:

Thus the C program to implement CSCAN disk scheduling has been written and executed successfully.

Ex.No.: 15e **CLOOK Disk Scheduling**

Aim:

To write a C program to implement CLOOK disk scheduling.

Algorithm:

1. Let Request array represents an array storing indexes of the tracks that have been requested in ascending order of their time of arrival and head is the position of the disk head.
2. The initial direction in which the head is moving is given and it services in the same direction.
3. The head services all the requests one by one in the direction it is moving.
4. The head continues to move in the same direction until all the requests in this direction have been serviced.
5. While moving in this direction, calculate the absolute distance of the tracks from the head.
6. Increment the total seeks count with this distance.
7. Currently serviced track position now becomes the new head position.
8. Go to step 5 until we reach the last request in this direction.
9. If we reach the last request in the current direction then reverse the direction and move the head in this direction until we reach the last request that is needed to be serviced in this direction without servicing the intermediate requests.
10. Reverse the direction and go to step 3 until all the requests have not been serviced.

Program:

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);
printf("Enter total disk size\n");
scanf("%d",&size);
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

   // logic for C-look disk scheduling

      /*logic for sort the request array */
   for(i=0;i<n;i++)
   {
for( j=0;j<n-i-1;j++)
```

```
        {
if(RQ[j]>RQ[j+1])
            {
                int temp;
                temp=RQ[j];
                RQ[j]=RQ[j+1];
                RQ[j+1]=temp;
            }

        }
    }

    int index;
    for(i=0;i<n;i++)
    {
        if(initial<RQ[i])
        {
            index=i;
            break;
        }
    }

    // if movement is towards high value
    if(move==1)
    {
        for(i=index;i<n;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }

for( i=0;i<index;i++)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
             initial=RQ[i];

        }
    }
    // if movement is towards low value
    else
    {
        for(i=index-1;i>=0;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }

        for(i=n-1;i>=index;i--)
        {
TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
```

```
            initial=RQ[i];

        }
     }

   printf("Total head movement is %d",TotalHeadMoment);
      return 0;
   }
```

Output:

```
Enter the number of Request
8
Enter the Requests Sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 322
```

Result:

Thus the C program to implement CLOOK disk scheduling has been written and executed successfully.

Ex.No : 16 **Install any guest operating system like Linux using VMware**
Date :

AIM:

To Install any guest operating system like Linux using VMware

Step 1: Download and install VMWare Player

Go to VMWare website and download the .exe file of VMWare Player. At the time of writing this article, VMWare player 16 is the latest version.

Download VMWare

Once downloaded, double-click the exe file and follow the on-screen instructions to install VMWare.

Step 2: Download the Linux ISO

Next, you need to download the ISO file of the Linux distribution. You can get this image from the official website of the Linux distribution you are trying to use.

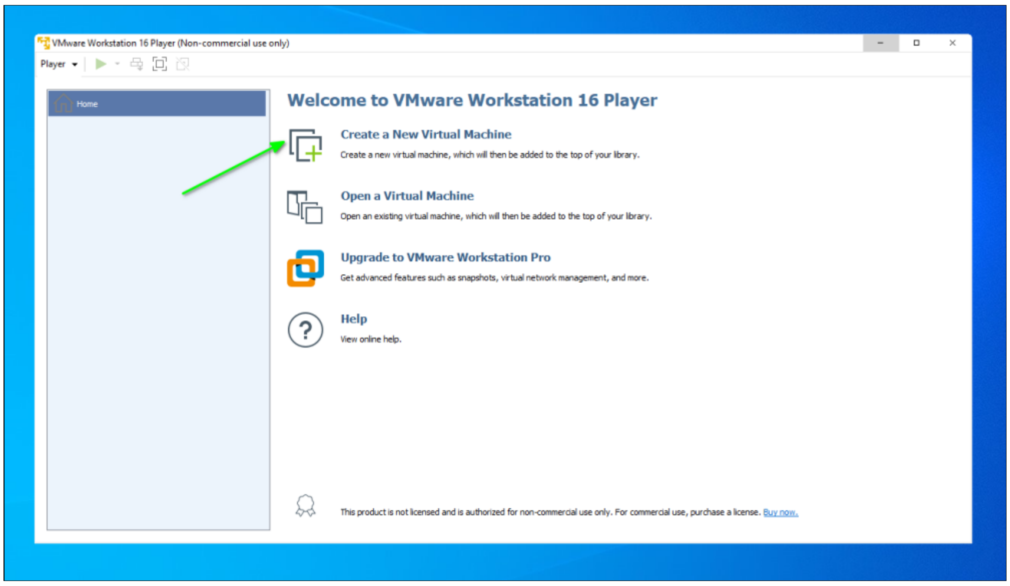
I am using Ubuntu in this example, and you can download ISO images for Ubuntu from the link below:

Download Ubuntu

Step 3: Install Linux using VMWare

You have installed VMWare and you have downloaded the ISO for Linux. You are now set to install Linux in VMware.

Now, start VMWare and click on **Create New Virtual Machine**.



Welcome to VMware Workstation 16 Player

Create a New Virtual Machine
Create a new virtual machine, which will then be added to the top of your library.

Open a Virtual Machine
Open an existing virtual machine, which will then be added to the top of your library.

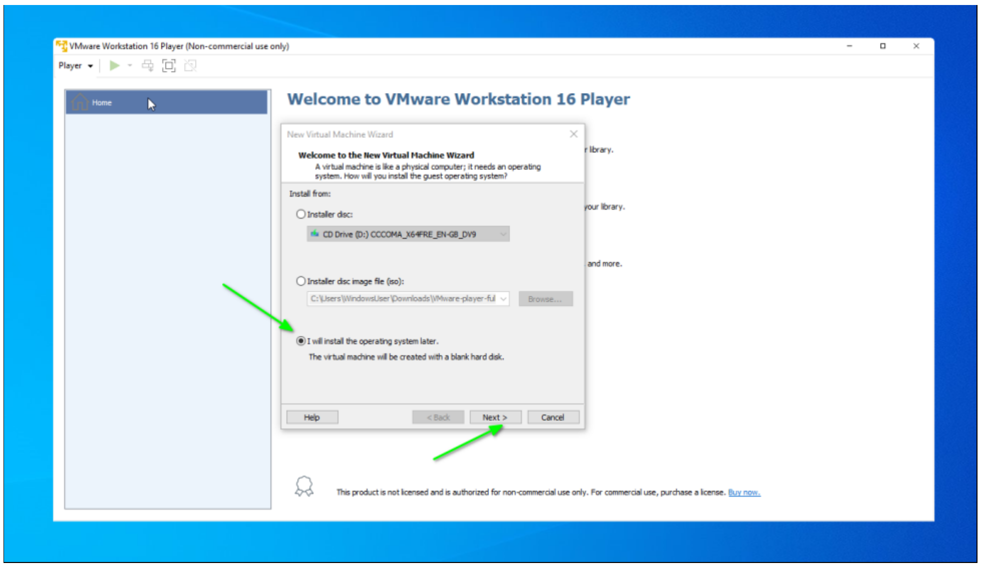
Upgrade to VMware Workstation Pro
Get advanced features such as snapshots, virtual network management, and more.

Help
View online help.

This product is not licensed and is authorized for non-commercial use only. For commercial use, purchase a license. Buy now.

Step 4: Create new virtual machine in VMWare

Select "I will install operating system later" option and press next.


VMware Workstation 16 Player (Non-commercial use only)
Player
Home
New Virtual Machine Wizard
Help
< Back
Next >
Cancel
Browse...

Welcome to VMware Workstation 16 Player

Welcome to the New Virtual Machine Wizard
A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?

Install from:

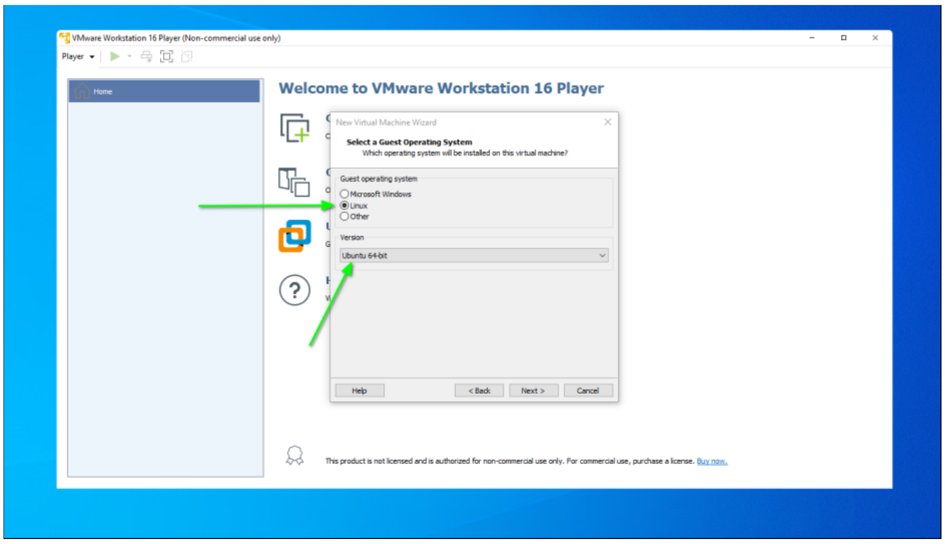
Installer disc: CD Drive (D:) CCCOMA_X64FRE_EN-GB_DV9

Installer disc image file (iso): C:\Users\WindowsUser\Downloads\VMware-player-ful

[✓ I will install the operating system later.]
The virtual machine will be created with a blank hard disk.

This product is not licensed and is authorized for non-commercial use only. For commercial use, purchase a license. Buy now.

Select install operating system later button. On the next screen, set the Operating system to Linux and the version to Ubuntu 64bit.


VMware Workstation 16 Player (Non-commercial use only)

Welcome to VMware Workstation 16 Player

New Virtual Machine Wizard

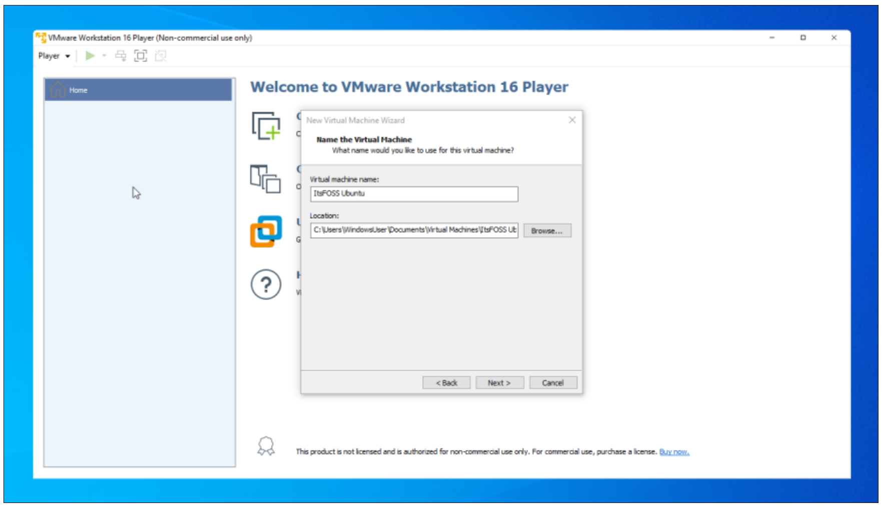
Select a Guest Operating System
Which operating system will be installed on this virtual machine?

Guest operating system
Microsoft Windows [✓ Linux] Other

Version
Ubuntu 64-bit

This product is not licensed and is authorized for non-commercial use only. For commercial use, purchase a license. Buy now.

Select Linux type and ubuntu 64 type. Give the virtual machine a name and press Next.


VMware Workstation 16 Player (Non-commercial use only)

Welcome to VMware Workstation 16 Player

New Virtual Machine Wizard

Name the Virtual Machine
What name would you like to use for this virtual machine?

Virtual machine name:
ItsFOSS Ubuntu

Location:
C:\Users\WindowsUser\Documents\Virtual Machines\ItsFOSS Ub

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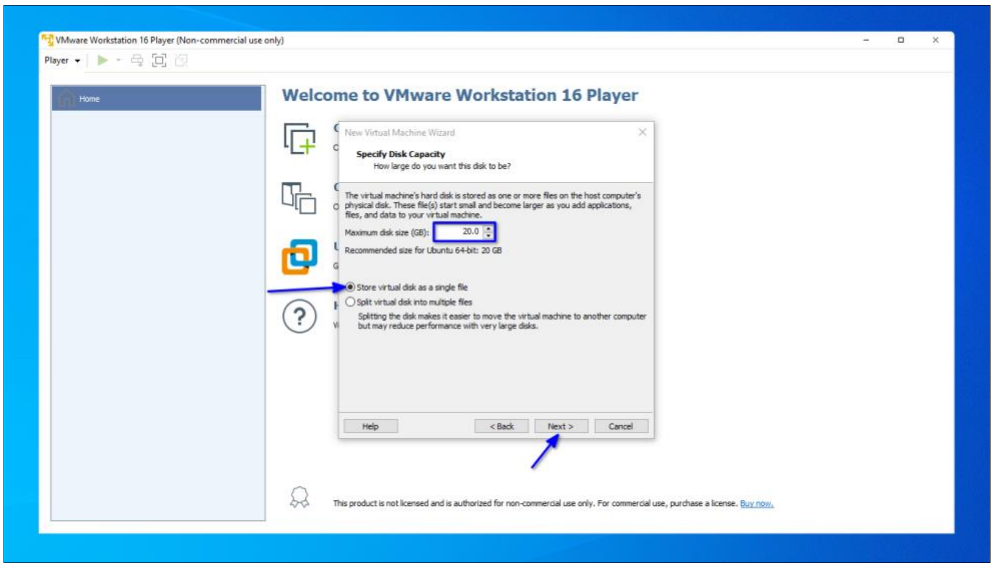
Step 5: Name the virtual machine

In the next screen, set the disk size to a minimum of 20 GB and also select “Store Virtual Disk as a single file” option.


VMware Workstation 16 Player (Non-commercial use only)
Player
Home
Welcome to VMware Workstation 16 Player
New Virtual Machine Wizard

Specify Disk Capacity
How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB): 20.0

Recommended size for Ubuntu 64-bit: 20 GB

(●) Store virtual disk as a single file
( ) Split virtual disk into multiple files
Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

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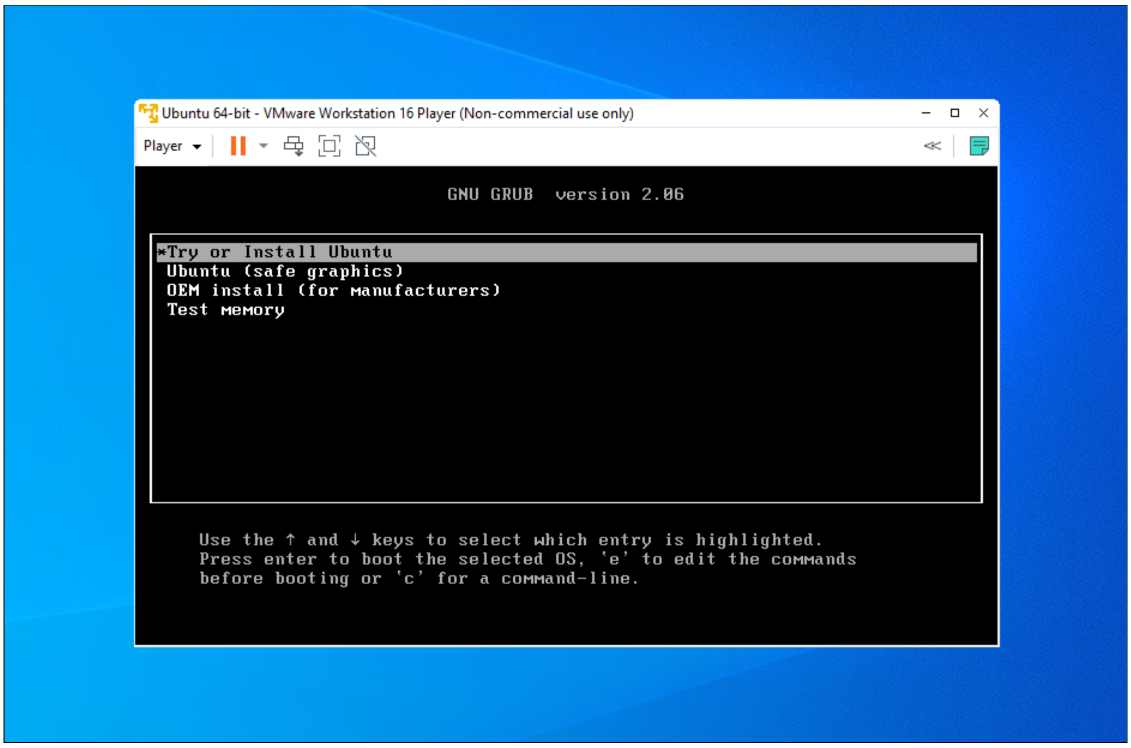
Step 6: Select disk size and store as single file

From the next screen, you can either press Finish and set ISO file later by right-clicking and Settings. Or you can select the ISO file on the go. For this, press “Customize Hardware” button. Once the created machine is opened, you will get the Ubuntu boot screen.


Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)
Player

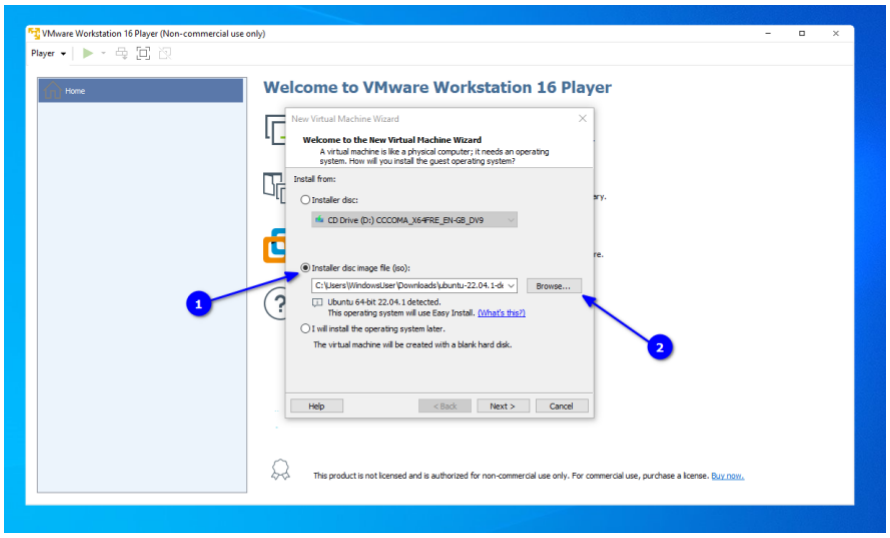
```
                         GNU GRUB  version 2.06

*Try or Install Ubuntu
 Ubuntu (safe graphics)
 OEM install (for manufacturers)
 Test memory

     Use the ↑ and ↓ keys to select which entry is highlighted.
     Press enter to boot the selected OS, 'e' to edit the commands
     before booting or 'c' for a command-line.
```

Step 7: Select the virtual machine to start install

you can select the downloaded ISO file and start the process.


VMware Workstation 16 Player (Non-commercial use only)

Welcome to VMware Workstation 16 Player

New Virtual Machine Wizard

Welcome to the New Virtual Machine Wizard
A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?

Install from:

( ) Installer disc:
CD Drive (D:) CCCOMA_X64FRE_EN-GB_DV9

(●) Installer disc image file (iso):
C:\Users\WindowsUser\Downloads\ubuntu-22.04.1-d
Ubuntu 64-bit 22.04.1 detected.
This operating system will use Easy Install. (What's this?)

( ) I will install the operating system later.
The virtual machine will be created with a blank hard disk.

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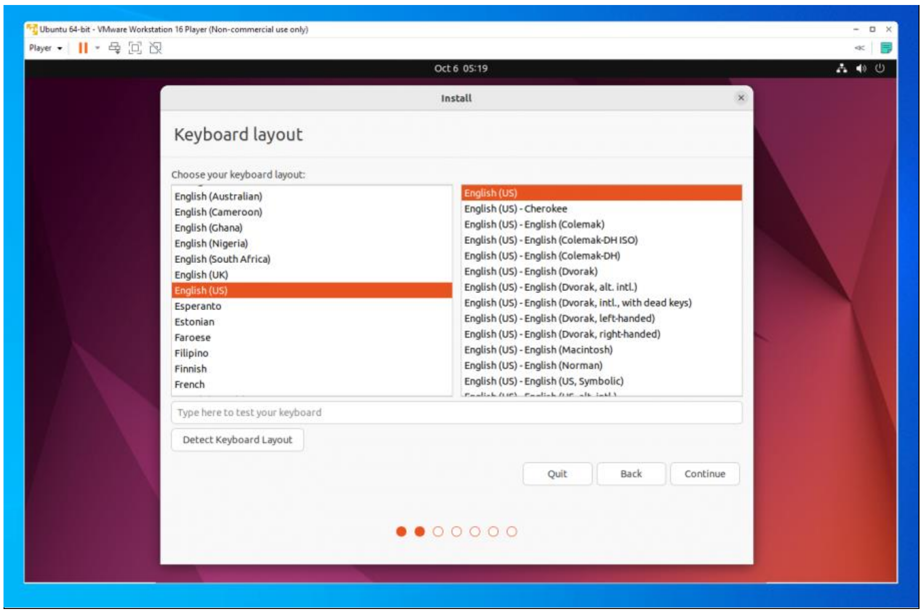
Step 8:Select install ubuntu to start installation process

Next, you need to set your Keyboard Layout, which by default is set to English US.


Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)

Oct 6 05:19

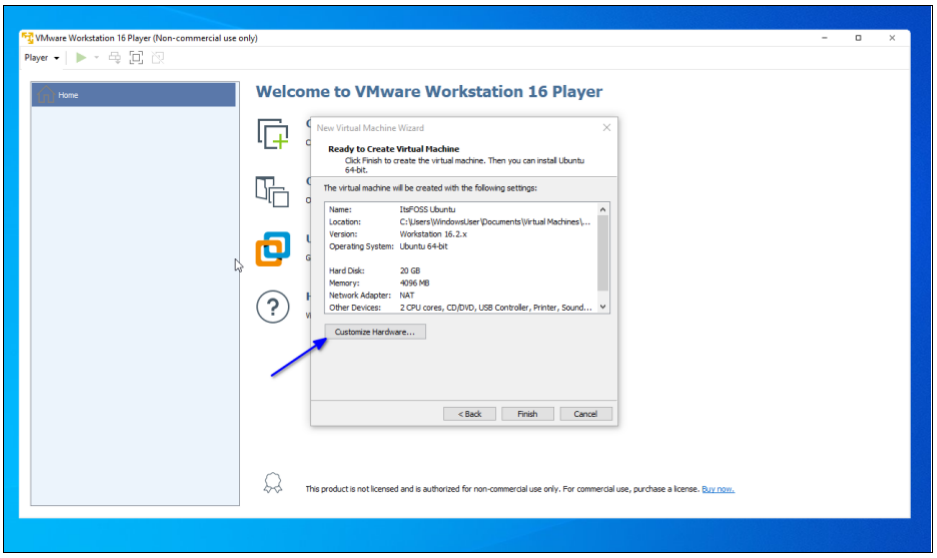
Install

Keyboard layout

Choose your keyboard layout:

English (Australian)	English (US)
English (Cameroon)	English (US) - Cherokee
English (Ghana)	English (US) - English (Colemak)
English (Nigeria)	English (US) - English (Colemak-DH ISO)
English (South Africa)	English (US) - English (Colemak-DH)
English (UK)	English (US) - English (Dvorak)
English (US)	English (US) - English (Dvorak, alt. intl.)
Esperanto	English (US) - English (Dvorak, intl., with dead keys)
Estonian	English (US) - English (Dvorak, left-handed)
Faroese	English (US) - English (Dvorak, right-handed)
Filipino	English (US) - English (Macintosh)
Finnish	English (US) - English (Norman)
French	English (US) - English (US, Symbolic)

Type here to test your keyboard


VMware Workstation 16 Player (Non-commercial use only)

Welcome to VMware Workstation 16 Player

New Virtual Machine Wizard

Ready to Create Virtual Machine
Click Finish to create the virtual machine. Then you can install Ubuntu 64-bit.

The virtual machine will be created with the following settings:

Name:	ItsFOSS Ubuntu
Location:	C:\Users\WindowsUser\Documents\Virtual Machines\...
Version:	Workstation 16.2.x
Operating System:	Ubuntu 64-bit
Hard Disk:	20 GB
Memory:	4096 MB
Network Adapter:	NAT
Other Devices:	2 CPU cores, CD/DVD, USB Controller, Printer, Sound...

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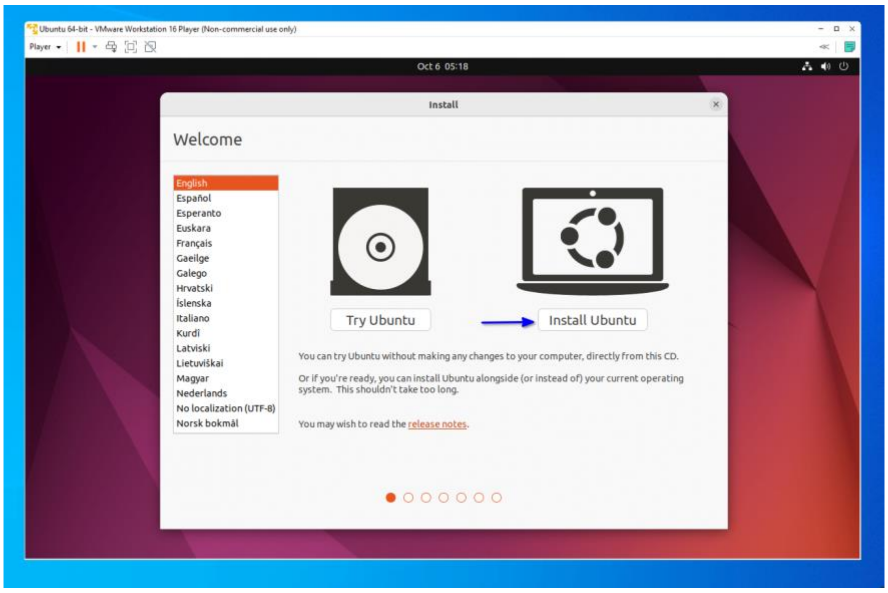
Step 9:Press Customize Hardware button


Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)

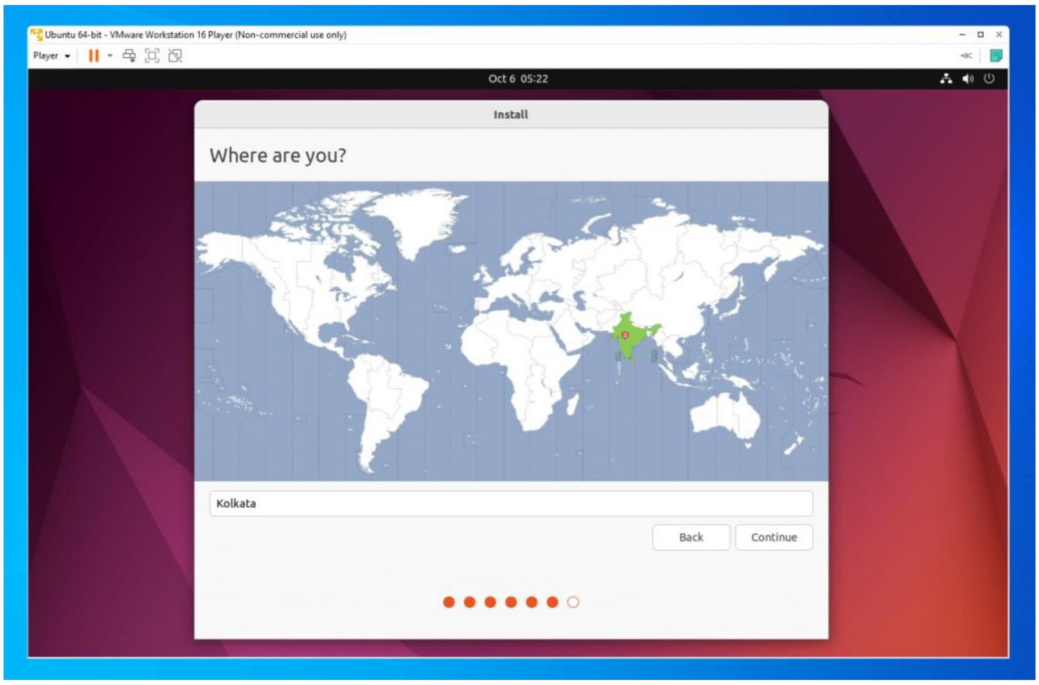
You can try Ubuntu without making any changes to your computer, directly from this CD.

Or if you're ready, you can install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long.

You may wish to read the release notes.

On this screen, you can tweak memory, processors, etc. But you need to select “New CD/DVD” button and add the Ubuntu ISO as shown in the screenshot:

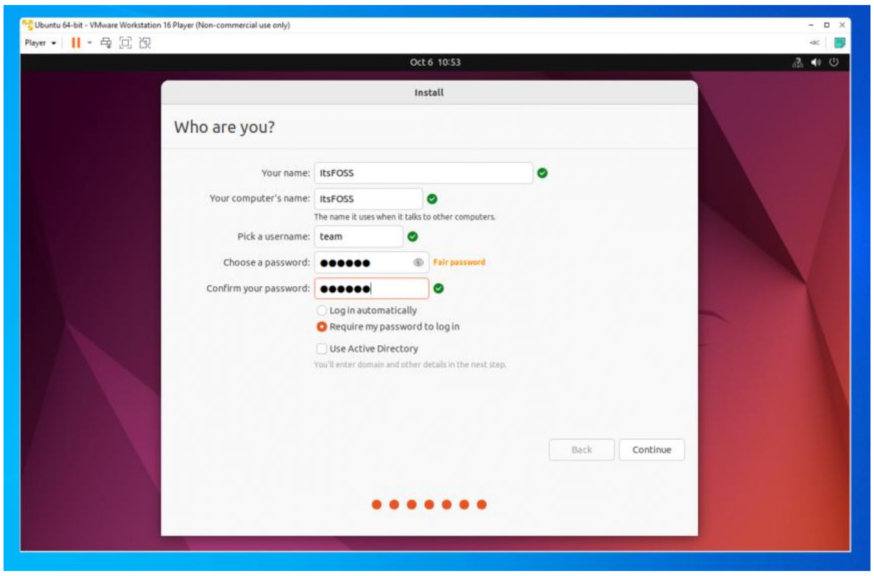
Once done with your settings, you can press the Install Now button. This will ask you to provide a time zone. Normally, it detects your time zone automatically. Otherwise, you can click on the region in the associated map to set your time zone


Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)
Player
Oct 6 05:22
Install
Back
Continue

Where are you?

Kolkata

Pressing Continue will ask you to provide user credentials like name, password etc. Provide them all and press Continue.


Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)
Player
Oct 6 10:53
Install
Back
Continue

Who are you?

Your name: ItsFOSS

Your computer's name: ItsFOSS

The name it uses when it talks to other computers.

Pick a username: team

Choose a password: ●●●●●● Fair password

Confirm your password: ●●●●●●

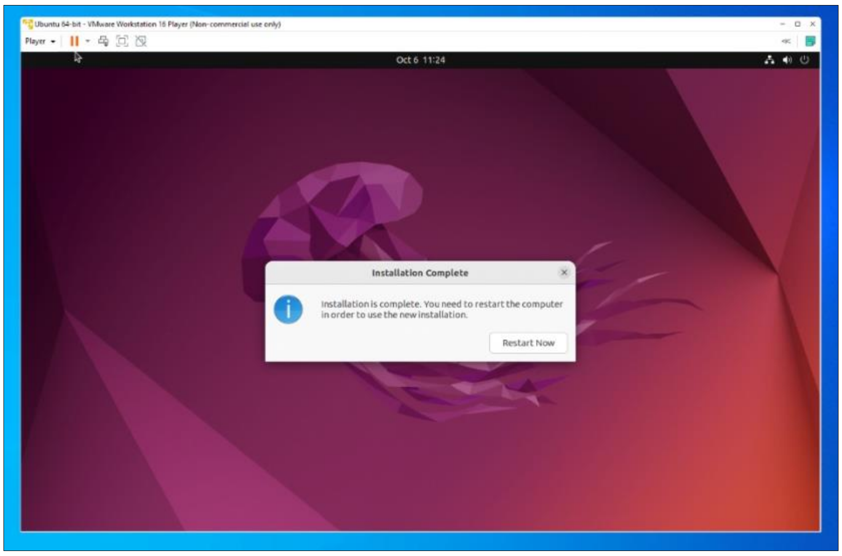
Log in automatically

[✓ Require my password to log in]

Use Active Directory

You'll enter domain and other details in the next step.

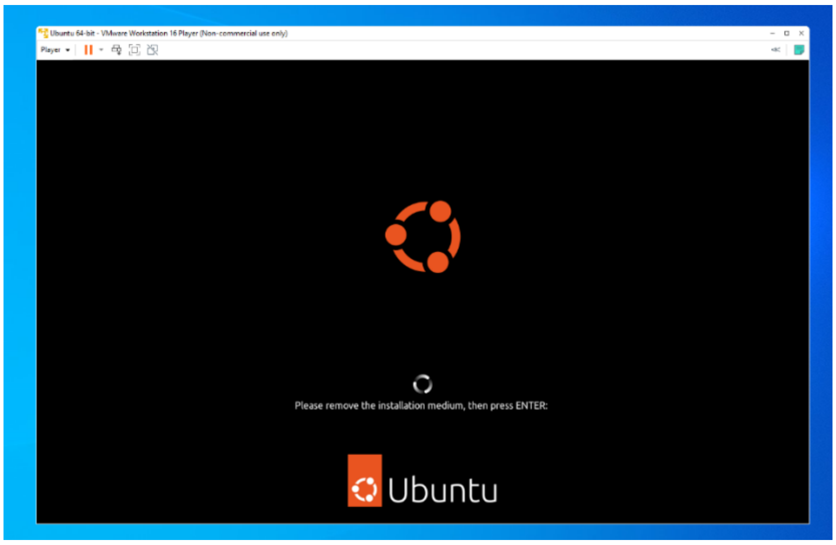
Now the installation will be started and once completed, you can start using Ubuntu by restarting the system.


Installation Complete

Installation is complete. You need to restart the computer in order to use the new installation.

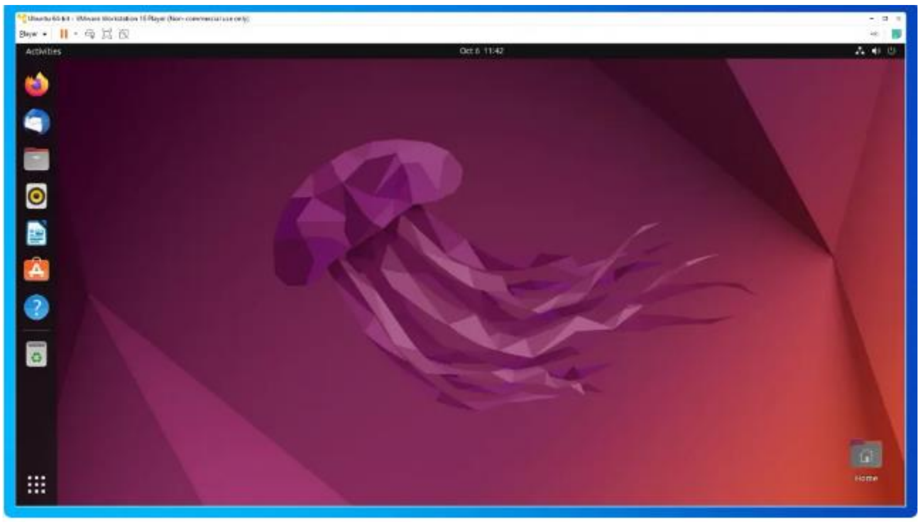
Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)
Player
Oct 6 11:24
Restart Now

Press the restart button once the installation is completed


Please remove the installation medium, then press ENTER:

Ubuntu 64-bit - VMware Workstation 16 Player (Non-commercial use only)
Player
Ubuntu

VMWare player menu button. Once done, you will have Ubuntu 22.04 installed inside VMWare.



Result:

Thus the Installation of guest operating system like Linux using VMware is installed successfully