21BDS0340

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Operating Systems Lab

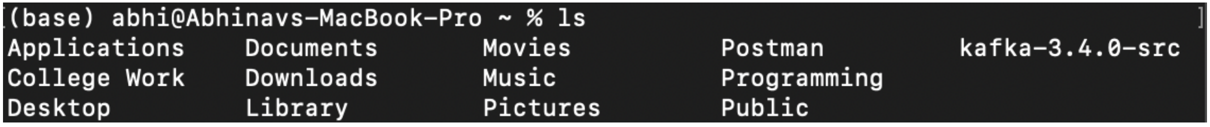
Assignment – I

Question 1

1. ls

Lists the files and directories in the current directory

Usage:

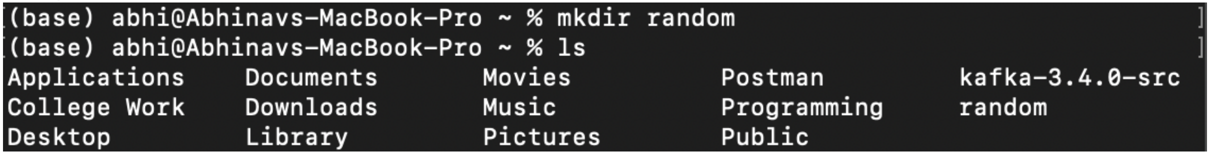


```
(base) abhi@Abhinavs-MacBook-Pro ~ % ls
Applications    Documents       Movies          Postman         kafka-3.4.0-src
College Work    Downloads       Music           Programming
Desktop         Library         Pictures        Public
```

2. mkdir <folder-name>

Makes a directory in the current directory with a given name as arguments

Usage:

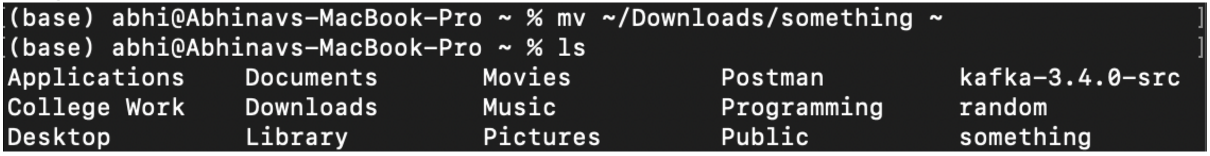


```
(base) abhi@Abhinavs-MacBook-Pro ~ % mkdir random
(base) abhi@Abhinavs-MacBook-Pro ~ % ls
Applications    Documents       Movies          Postman         kafka-3.4.0-src
College Work    Downloads       Music           Programming     random
Desktop         Library         Pictures        Public
```

3. mv <source-file> <destination-file>

Moves a files/directory from the first argument destination to the second argument destination

Usage:

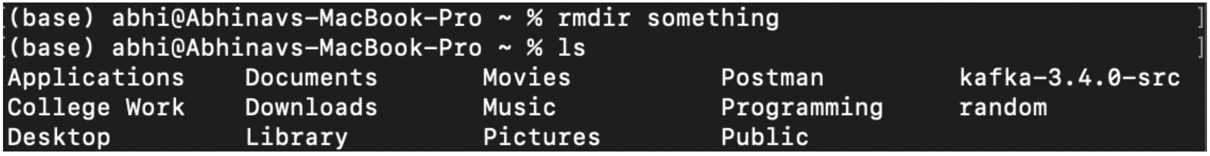


```
(base) abhi@Abhinavs-MacBook-Pro ~ % mv ~/Downloads/something ~
(base) abhi@Abhinavs-MacBook-Pro ~ % ls
Applications    Documents       Movies          Postman         kafka-3.4.0-src
College Work    Downloads       Music           Programming     random
Desktop         Library         Pictures        Public          something
```

4. rmdir <folder>

Removes an empty directory from the current directory

Usage:

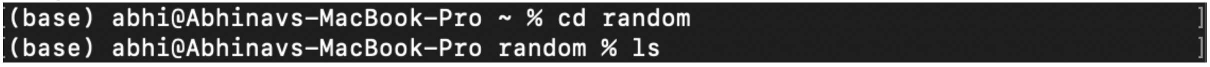


```
(base) abhi@Abhinavs-MacBook-Pro ~ % rmdir something
(base) abhi@Abhinavs-MacBook-Pro ~ % ls
Applications    Documents       Movies          Postman         kafka-3.4.0-src
College Work    Downloads       Music           Programming     random
Desktop         Library         Pictures        Public
```

5. cd <folder>

Changes the directory to the directory given as an argument relative to the current directory

Usage:

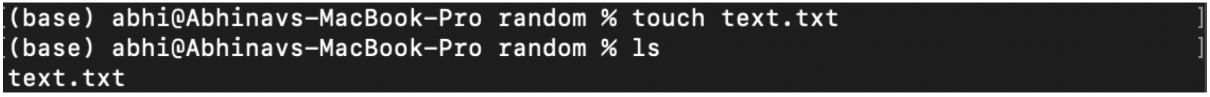


```
(base) abhi@Abhinavs-MacBook-Pro ~ % cd random
(base) abhi@Abhinavs-MacBook-Pro random % ls
```

6. touch <filename>

Creates a new file in the current directory and names it as the argument

Usage:

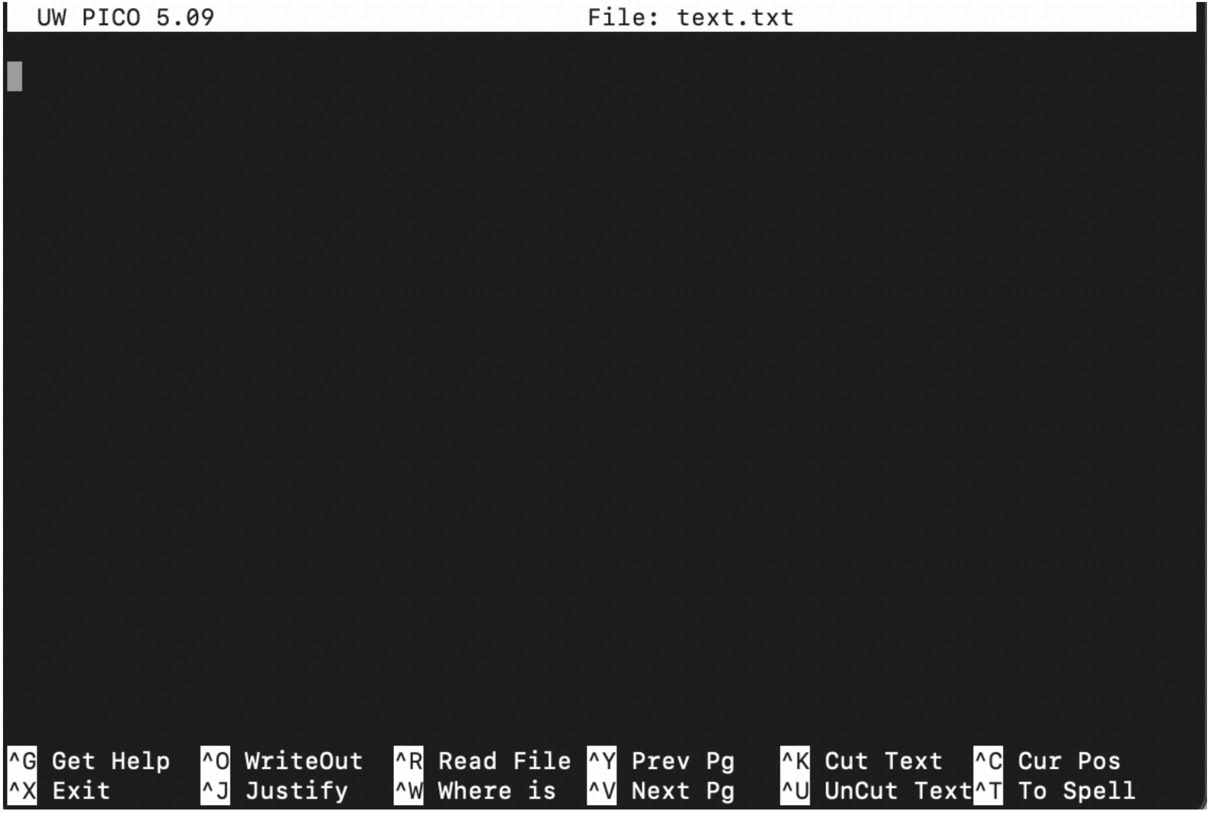


```
(base) abhi@Abhinavs-MacBook-Pro random % touch text.txt
(base) abhi@Abhinavs-MacBook-Pro random % ls
text.txt
```

7. nano <filename>

Opens the file passed as arguments in the nano editor from the current directory

Usage:

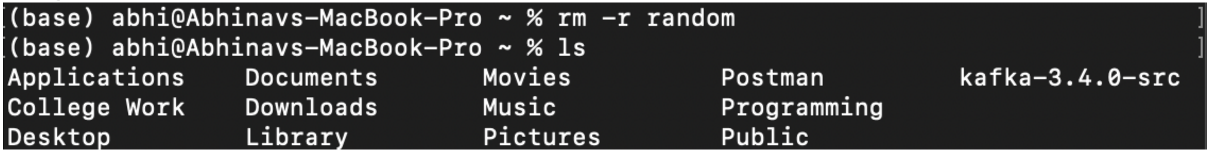


```
  UW PICO 5.09                         File: text.txt

^G Get Help   ^O WriteOut   ^R Read File  ^Y Prev Pg    ^K Cut Text   ^C Cur Pos
^X Exit       ^J Justify    ^W Where is   ^V Next Pg    ^U UnCut Text^T To Spell
```

8. rm -r <folder>

Recursively remove a folder and all its content from the current directory

Usage:

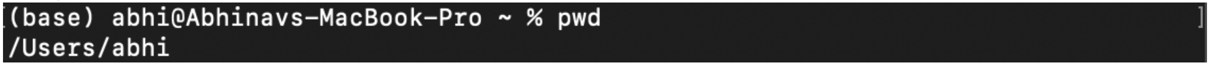


```
(base) abhi@Abhinavs-MacBook-Pro ~ % rm -r random
(base) abhi@Abhinavs-MacBook-Pro ~ % ls
Applications    Documents       Movies          Postman         kafka-3.4.0-src
College Work    Downloads       Music           Programming
Desktop         Library         Pictures        Public
```

9. pwd

Display the current working directory’s absolute path

Usage:

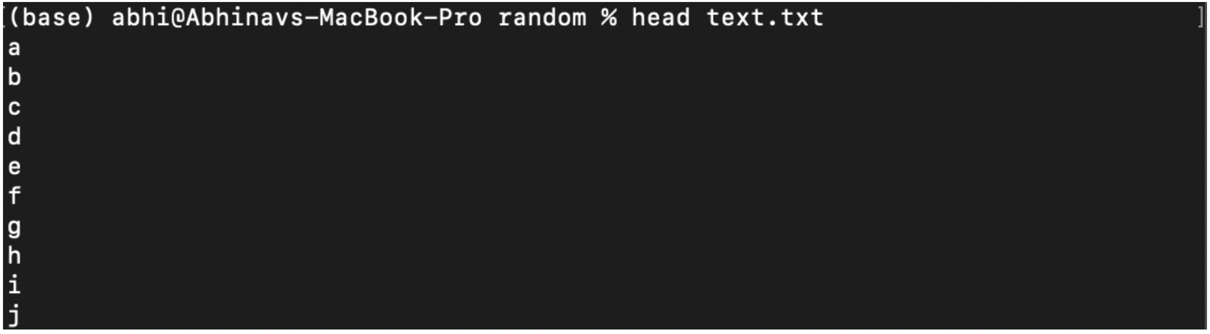


```
(base) abhi@Abhinavs-MacBook-Pro ~ % pwd
/Users/abhi
```

10. head <filename>

Display the first 10 lines of a file in the current directory

Usage:

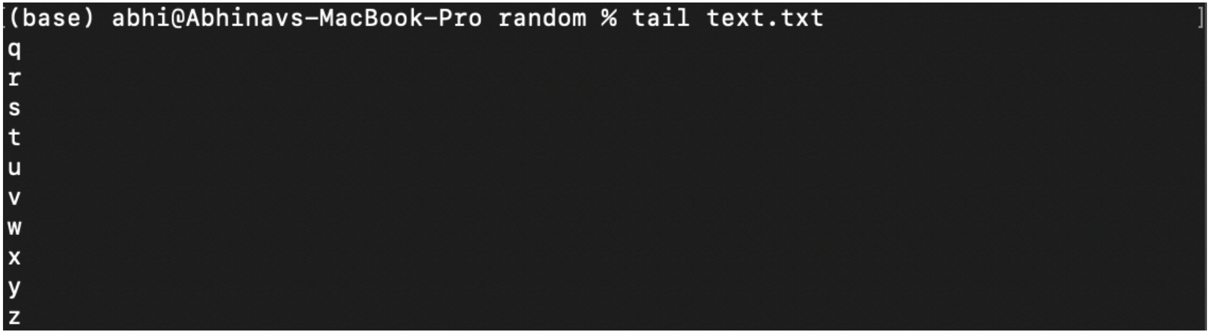


```
(base) abhi@Abhinavs-MacBook-Pro random % head text.txt
a
b
c
d
e
f
g
h
i
j
```

11. tail <filename>

Display the last 10 lines of a file in the current directory

Usage:

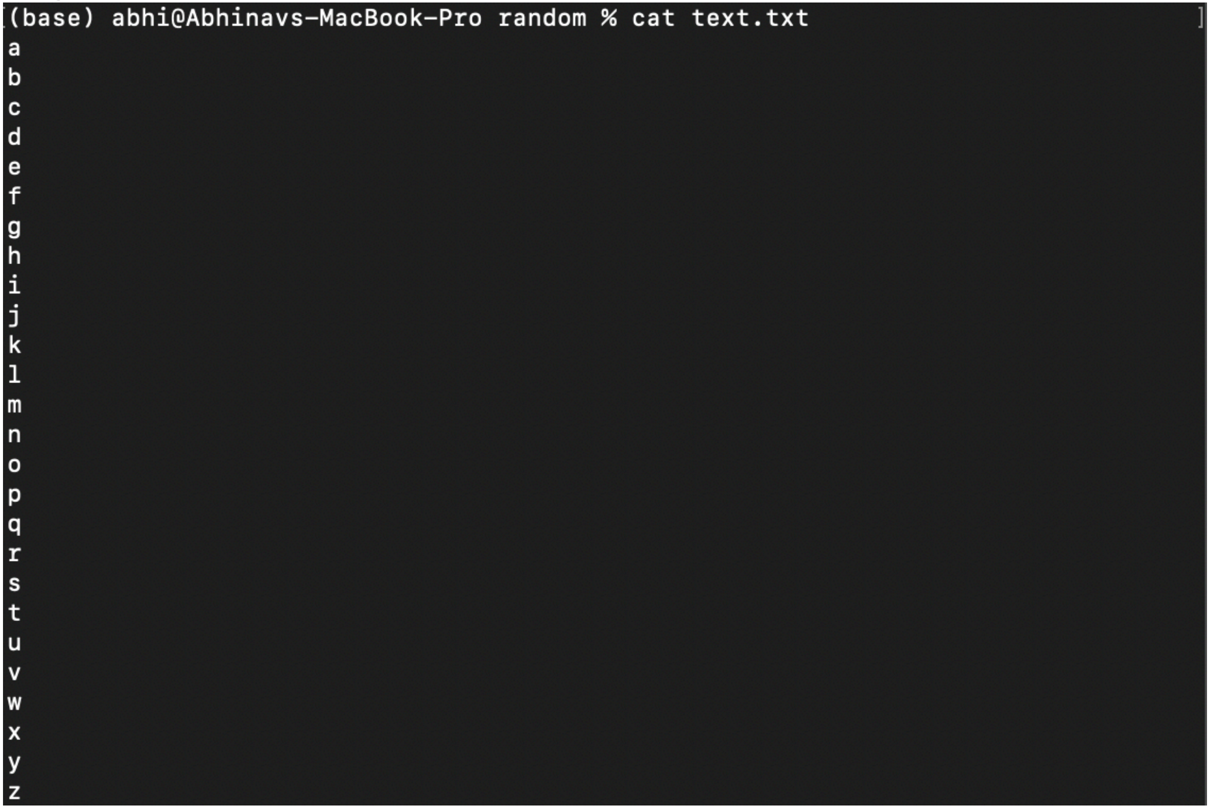


```
(base) abhi@Abhinavs-MacBook-Pro random % tail text.txt
q
r
s
t
u
v
w
x
y
z
```

12. cat <filename>

Display the file given as arguments in the current directory

Usage:

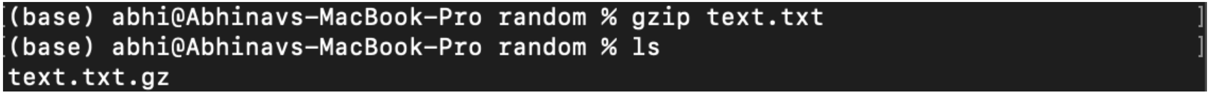


```
(base) abhi@Abhinavs-MacBook-Pro random % cat text.txt
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
y
z
```

13. gzip <filename>

Zip the filename given as arguments in the current directory

Usage:

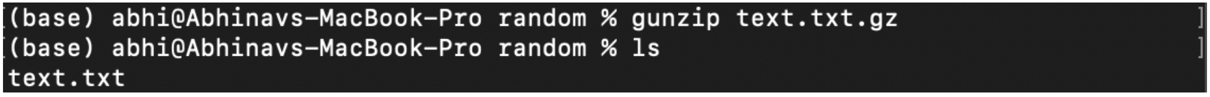


```
(base) abhi@Abhinavs-MacBook-Pro random % gzip text.txt
(base) abhi@Abhinavs-MacBook-Pro random % ls
text.txt.gz
```

14. gunzip <filename>

Unzip the filename given as arguments in the current directory

Usage:

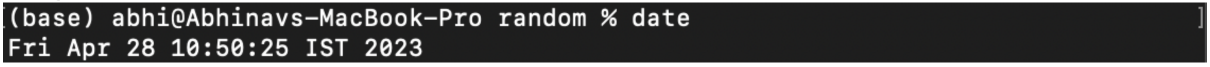


```
(base) abhi@Abhinavs-MacBook-Pro random % gunzip text.txt.gz
(base) abhi@Abhinavs-MacBook-Pro random % ls
text.txt
```

15. date

Displays the current date

Usage:

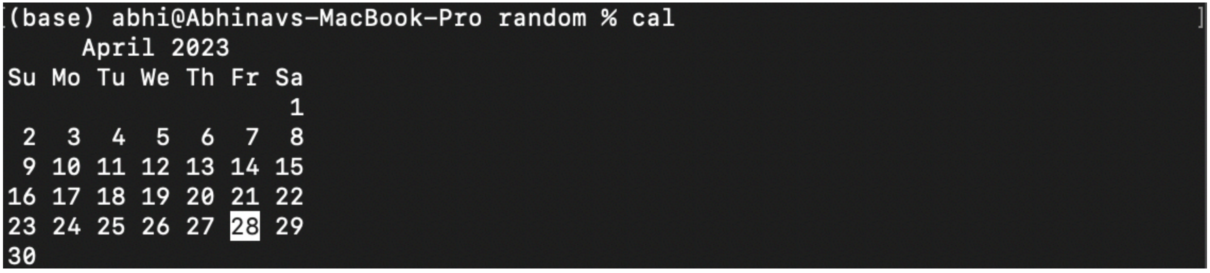


```
(base) abhi@Abhinavs-MacBook-Pro random % date
Fri Apr 28 10:50:25 IST 2023
```

16. cal

Displays the calendar with the date highlighted

Usage:



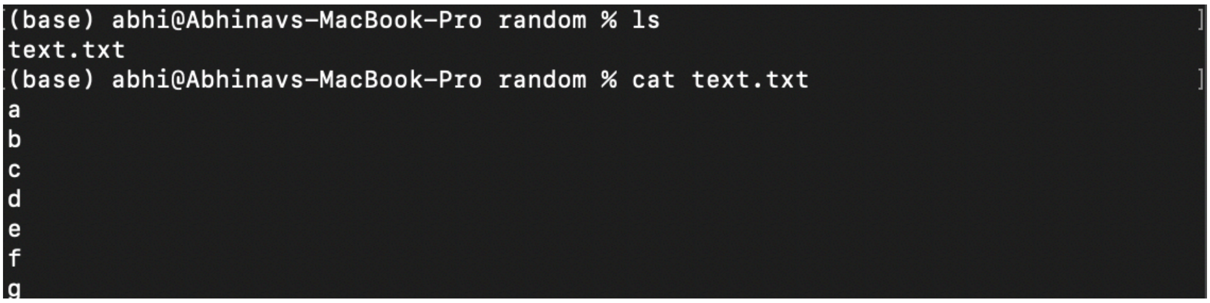
```
(base) abhi@Abhinavs-MacBook-Pro random % cal
     April 2023
Su Mo Tu We Th Fr Sa
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
```

17. clear

Clears the terminal screen

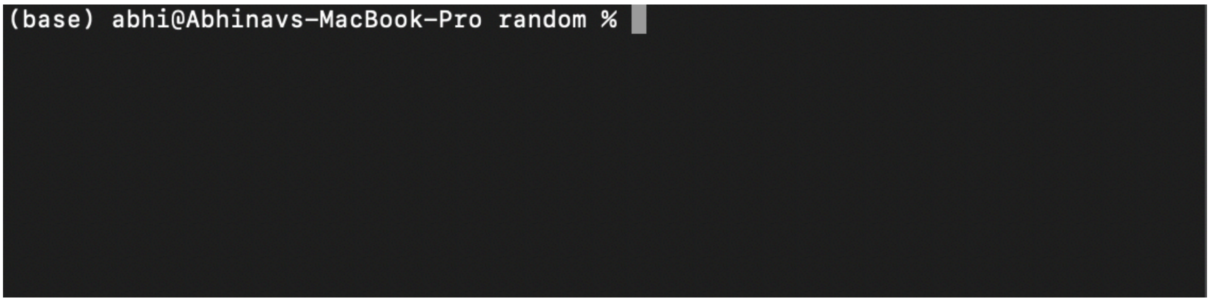
Usage:

Before:



```
(base) abhi@Abhinavs-MacBook-Pro random % ls
text.txt
(base) abhi@Abhinavs-MacBook-Pro random % cat text.txt
a
b
c
d
e
f
g
```

After:

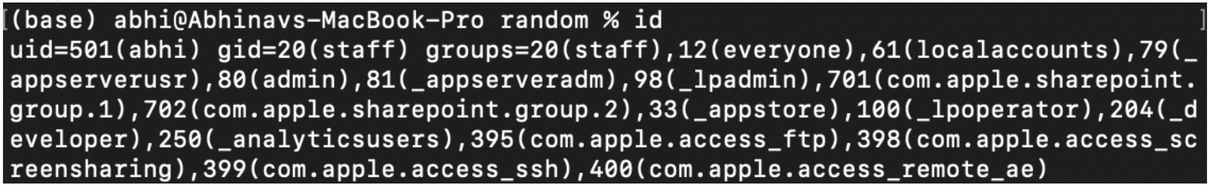


```
(base) abhi@Abhinavs-MacBook-Pro random %
```

18. id

Displays information about the current user id

Usage:

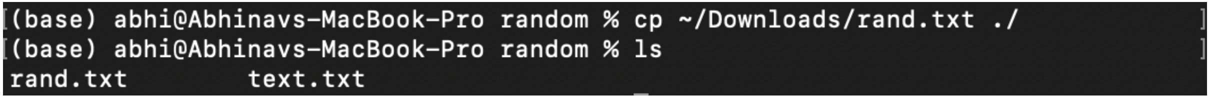


```
(base) abhi@Abhinavs-MacBook-Pro random % id
uid=501(abhi) gid=20(staff) groups=20(staff),12(everyone),61(localaccounts),79(_
appserverusr),80(admin),81(_appserveradm),98(_lpadmin),701(com.apple.sharepoint.
group.1),702(com.apple.sharepoint.group.2),33(_appstore),100(_lpoperator),204(_d
eveloper),250(_analyticsusers),395(com.apple.access_ftp),398(com.apple.access_sc
reensharing),399(com.apple.access_ssh),400(com.apple.access_remote_ae)
```

19. cp <source-file> <destination-folder>

Copy the given file from the first arguments to the second argument

Usage:

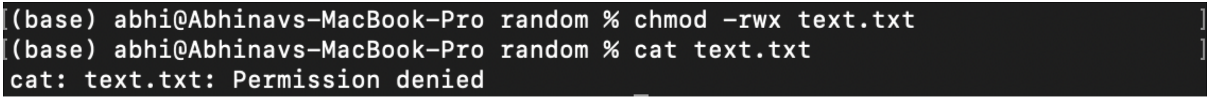


```
(base) abhi@Abhinavs-MacBook-Pro random % cp ~/Downloads/rand.txt ./
(base) abhi@Abhinavs-MacBook-Pro random % ls
rand.txt        text.txt
```

20. chmod <+[rwx]/-[rwx]> <filename>

Changes the given files permissions with options for reading, writing and being executable

Usage:

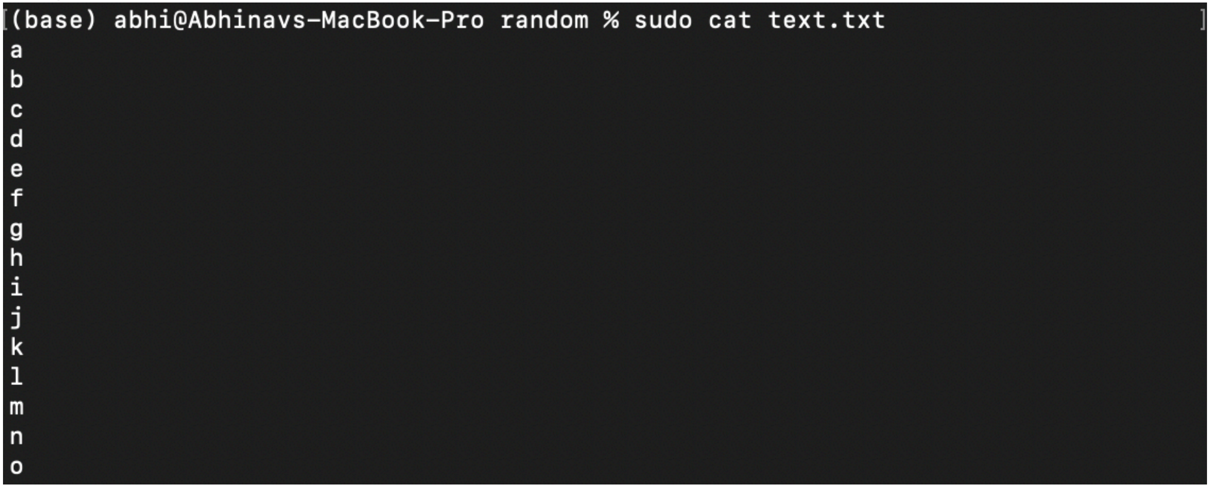


```
(base) abhi@Abhinavs-MacBook-Pro random % chmod -rwx text.txt
(base) abhi@Abhinavs-MacBook-Pro random % cat text.txt
cat: text.txt: Permission denied
```

21. sudo <command>

Run a command as super user to bypass permissions set

Usage:

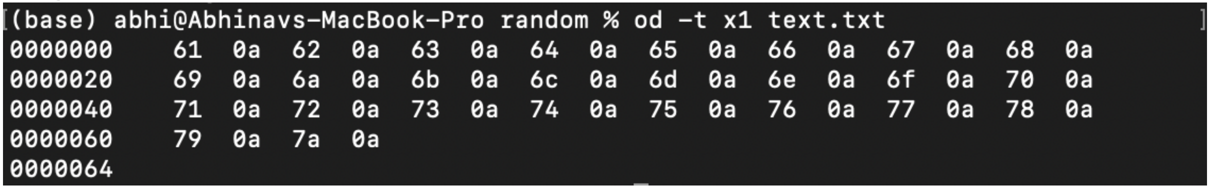


```
(base) abhi@Abhinavs-MacBook-Pro random % sudo cat text.txt
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
```

22. od –[b/t/c] <filename>

Display the content of a file in the given format from the current directory

Usage:

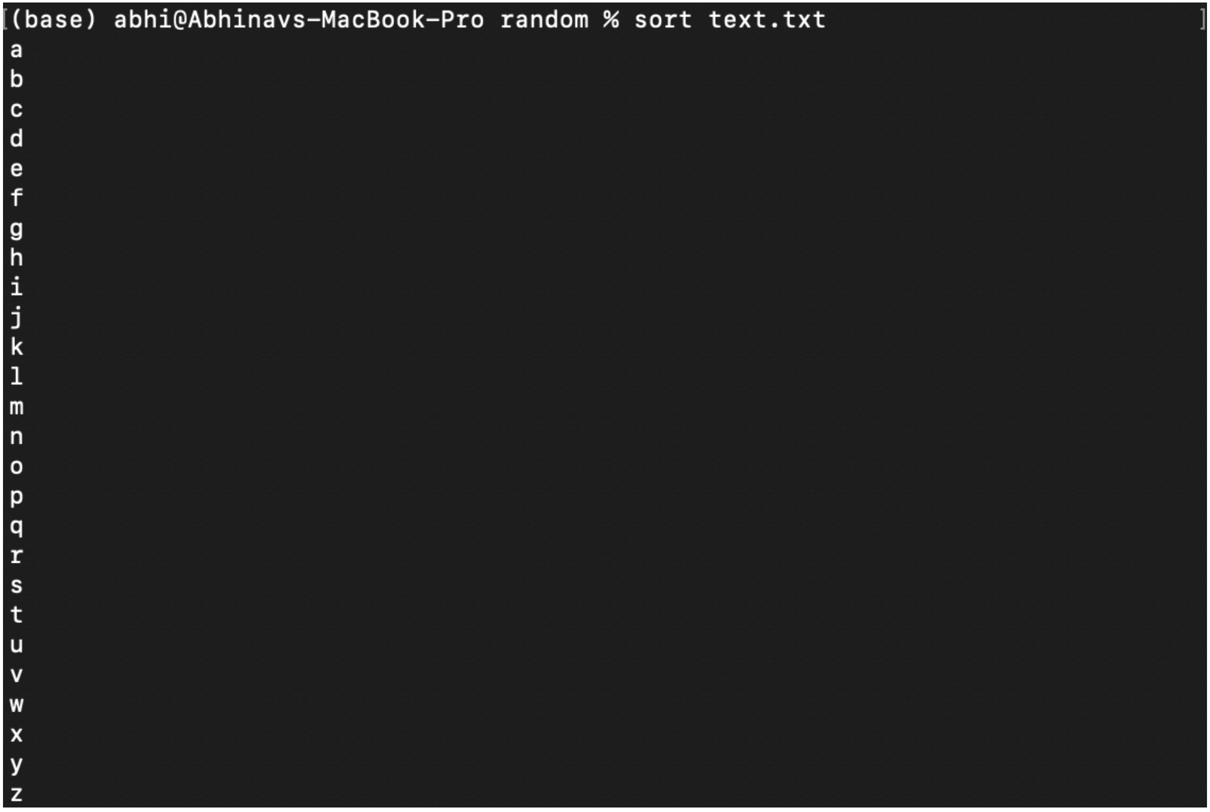


```
(base) abhi@Abhinavs-MacBook-Pro random % od -t x1 text.txt
0000000    61  0a  62  0a  63  0a  64  0a  65  0a  66  0a  67  0a  68  0a
0000020    69  0a  6a  0a  6b  0a  6c  0a  6d  0a  6e  0a  6f  0a  70  0a
0000040    71  0a  72  0a  73  0a  74  0a  75  0a  76  0a  77  0a  78  0a
0000060    79  0a  7a  0a
0000064
```

23. sort <filename>

Sort the content of a file by alphabetic order from the current directory

Usage: Same output, because contents are already sorted

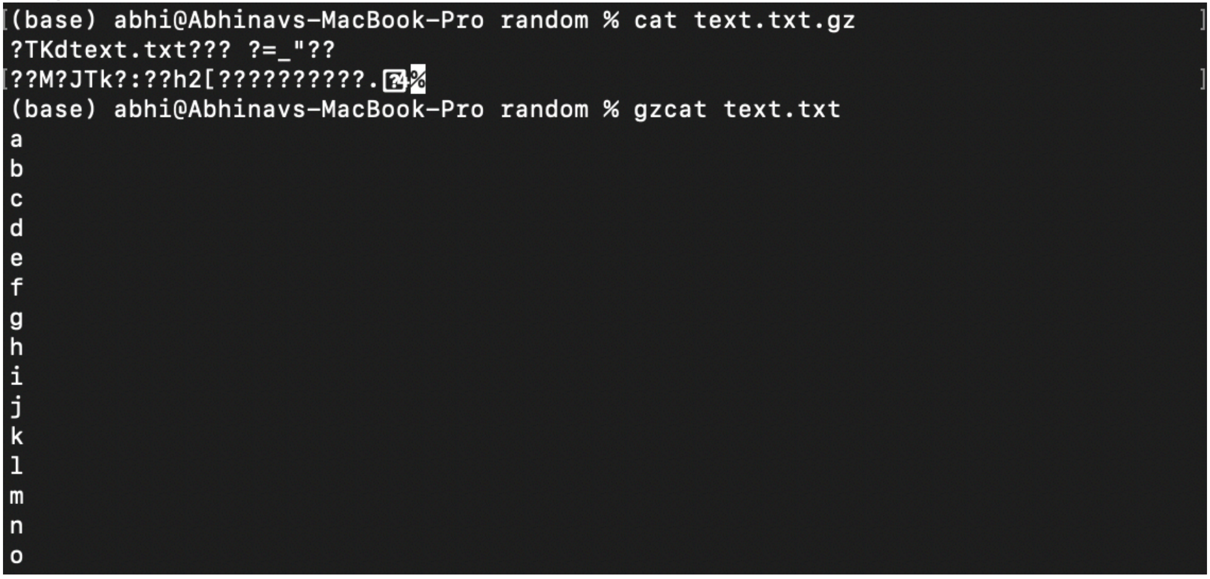


```
(base) abhi@Abhinavs-MacBook-Pro random % sort text.txt
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
y
z
```

24. gzcat <filename>

Display a gzipped file from the current directory

Usage:

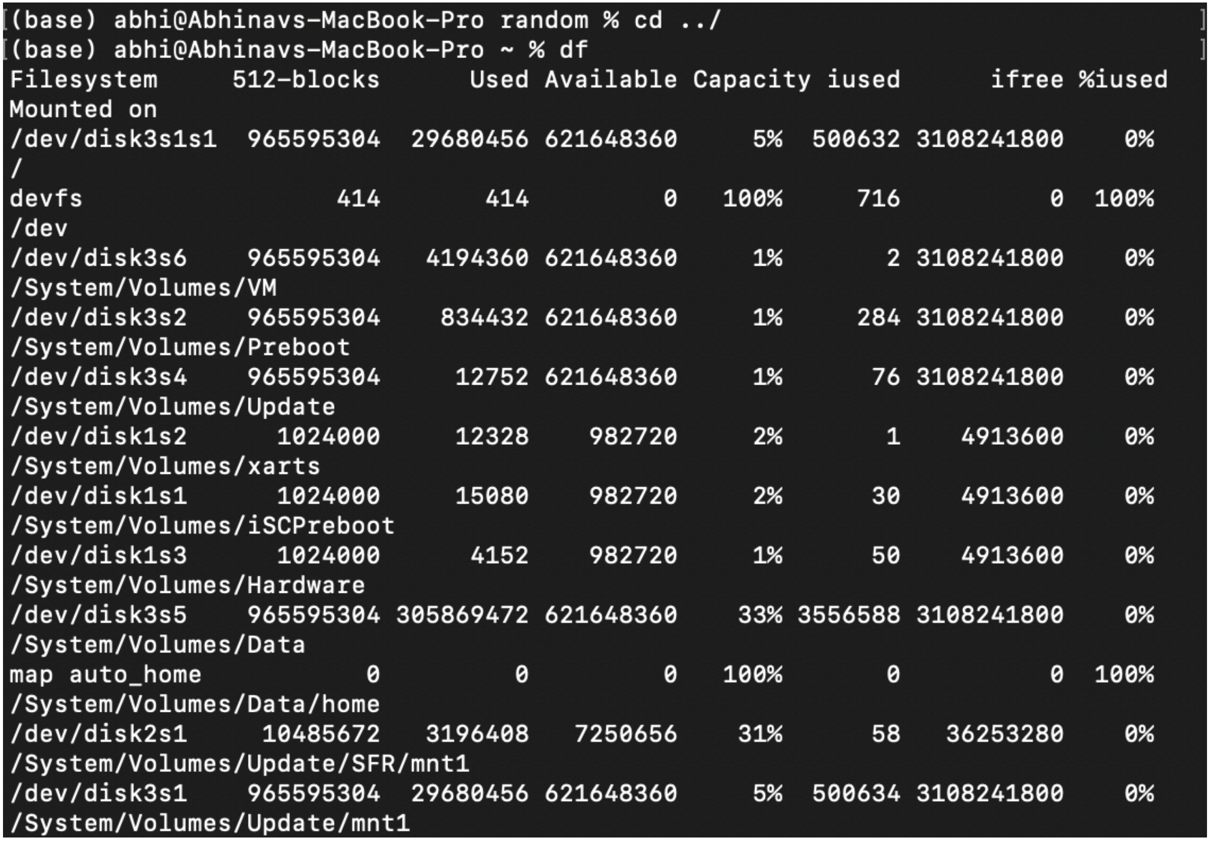


```
[(base) abhi@Abhinavs-MacBook-Pro random % cat text.txt.gz
?TKdtext.txt??? ?=_"??
[??M?JTk?:??h2[??????????.?4%
(base) abhi@Abhinavs-MacBook-Pro random % gzcat text.txt
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
```

25. df

Display the disk size used by files in the current directory

Usage:

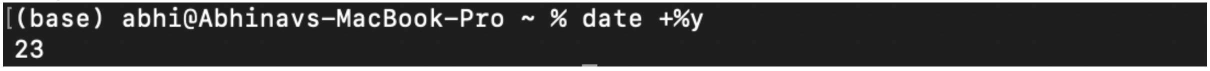


```
[(base) abhi@Abhinavs-MacBook-Pro random % cd ../
[(base) abhi@Abhinavs-MacBook-Pro ~ % df
Filesystem     512-blocks      Used Available Capacity iused      ifree %iused
Mounted on
/dev/disk3s1s1  965595304  29680456 621648360     5%  500632 3108241800    0%
/
devfs                 414       414         0   100%     716          0  100%
/dev
/dev/disk3s6    965595304   4194360 621648360     1%       2 3108241800    0%
/System/Volumes/VM
/dev/disk3s2    965595304    834432 621648360     1%     284 3108241800    0%
/System/Volumes/Preboot
/dev/disk3s4    965595304     12752 621648360     1%      76 3108241800    0%
/System/Volumes/Update
/dev/disk1s2      1024000     12328    982720     2%       1    4913600    0%
/System/Volumes/xarts
/dev/disk1s1      1024000     15080    982720     2%      30    4913600    0%
/System/Volumes/iSCPreboot
/dev/disk1s3      1024000      4152    982720     1%      50    4913600    0%
/System/Volumes/Hardware
/dev/disk3s5    965595304 305869472 621648360    33% 3556588 3108241800    0%
/System/Volumes/Data
map auto_home           0         0         0   100%       0          0  100%
/System/Volumes/Data/home
/dev/disk2s1     10485672   3196408   7250656    31%      58   36253280    0%
/System/Volumes/Update/SFR/mnt1
/dev/disk3s1    965595304  29680456 621648360     5%  500634 3108241800    0%
/System/Volumes/Update/mnt1
```

26. date +%format

Display a specific attribute of the date or in a specific format.

Usage:

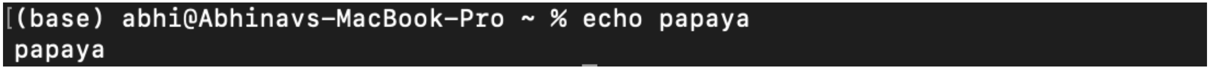


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % date +%y
23
```

27. echo

Display text given as an argument

Usage:

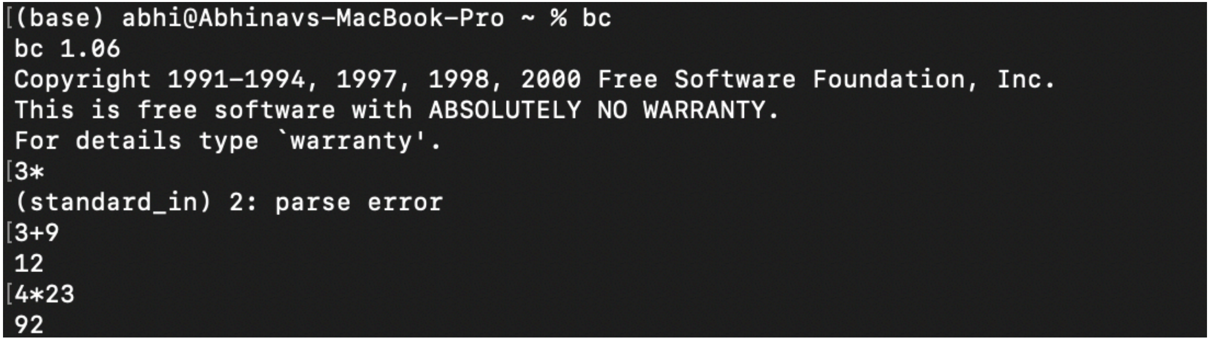


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % echo papaya
papaya
```

28. bc

API to access a basic calculator

Usage:

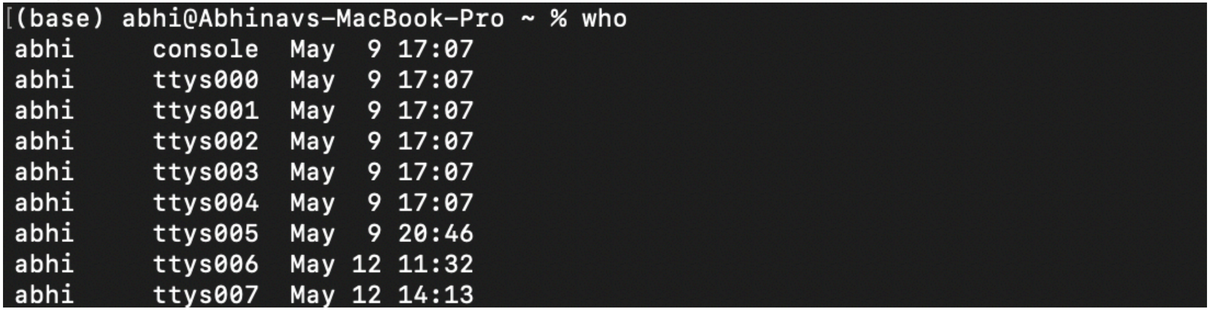


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % bc
bc 1.06
Copyright 1991-1994, 1997, 1998, 2000 Free Software Foundation, Inc.
This is free software with ABSOLUTELY NO WARRANTY.
For details type `warranty'.
[3*
(standard_in) 2: parse error
[3+9
12
[4*23
92
```

29. who

Displays information about the user

Usage:

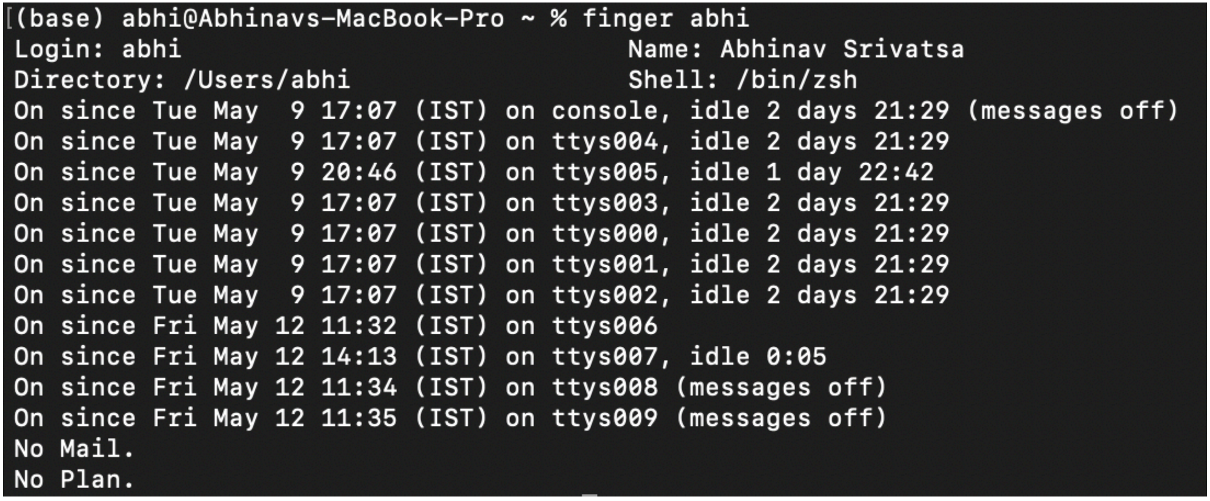


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % who
abhi     console  May  9 17:07
abhi     ttys000  May  9 17:07
abhi     ttys001  May  9 17:07
abhi     ttys002  May  9 17:07
abhi     ttys003  May  9 17:07
abhi     ttys004  May  9 17:07
abhi     ttys005  May  9 20:46
abhi     ttys006  May 12 11:32
abhi     ttys007  May 12 14:13
```

30. finger

Displays information about a specific user given as arguments.

Usage:

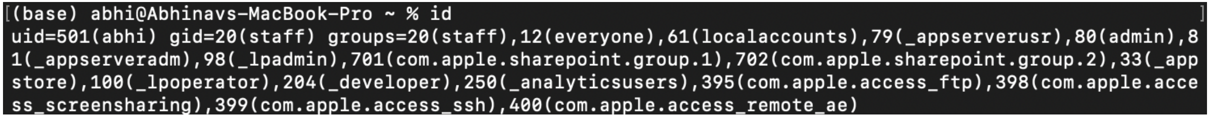


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % finger abhi
 Login: abhi                             Name: Abhinav Srivatsa
 Directory: /Users/abhi                  Shell: /bin/zsh
 On since Tue May  9 17:07 (IST) on console, idle 2 days 21:29 (messages off)
 On since Tue May  9 17:07 (IST) on ttys004, idle 2 days 21:29
 On since Tue May  9 20:46 (IST) on ttys005, idle 1 day 22:42
 On since Tue May  9 17:07 (IST) on ttys003, idle 2 days 21:29
 On since Tue May  9 17:07 (IST) on ttys000, idle 2 days 21:29
 On since Tue May  9 17:07 (IST) on ttys001, idle 2 days 21:29
 On since Tue May  9 17:07 (IST) on ttys002, idle 2 days 21:29
 On since Fri May 12 11:32 (IST) on ttys006
 On since Fri May 12 14:13 (IST) on ttys007, idle 0:05
 On since Fri May 12 11:34 (IST) on ttys008 (messages off)
 On since Fri May 12 11:35 (IST) on ttys009 (messages off)
 No Mail.
 No Plan.
```

31. id

Displays information about a user related to user id and group id, this is for file/system permissions.

Usage:

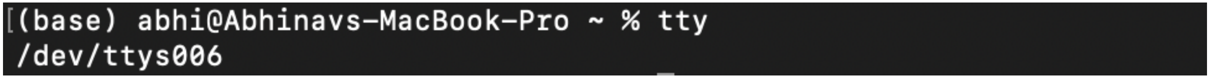


```
[(base) abhi@Abhinavs-MacBook-Pro ~ % id                                                              ]
 uid=501(abhi) gid=20(staff) groups=20(staff),12(everyone),61(localaccounts),79(_appserverusr),80(admin),8
 1(_appserveradm),98(_lpadmin),701(com.apple.sharepoint.group.1),702(com.apple.sharepoint.group.2),33(_app
 store),100(_lpoperator),204(_developer),250(_analyticsusers),395(com.apple.access_ftp),398(com.apple.acce
 ss_screensharing),399(com.apple.access_ssh),400(com.apple.access_remote_ae)
```

32. tty

Displays the terminal file

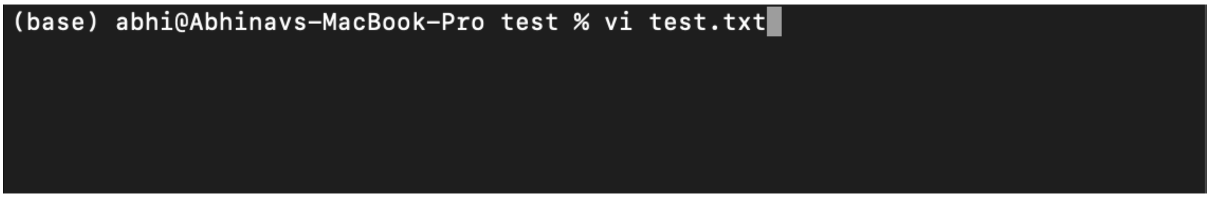
Usage:



```
[(base) abhi@Abhinavs-MacBook-Pro ~ % tty
 /dev/ttys006
```

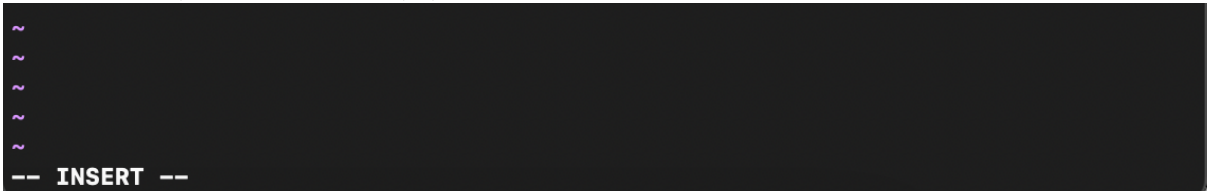
Question 2

Command to access vi:



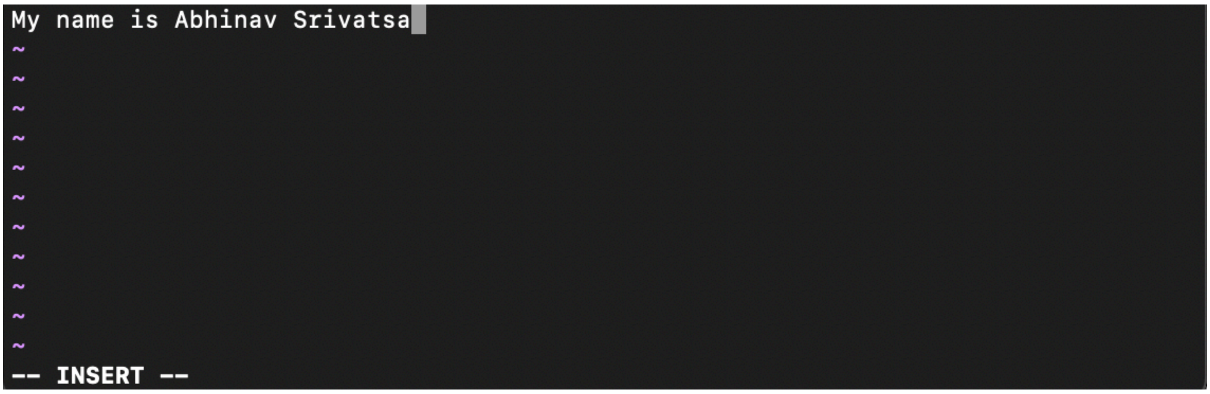
```
(base) abhi@Abhinavs-MacBook-Pro test % vi test.txt
```

Insert mode (press i), ~ are empty lines:



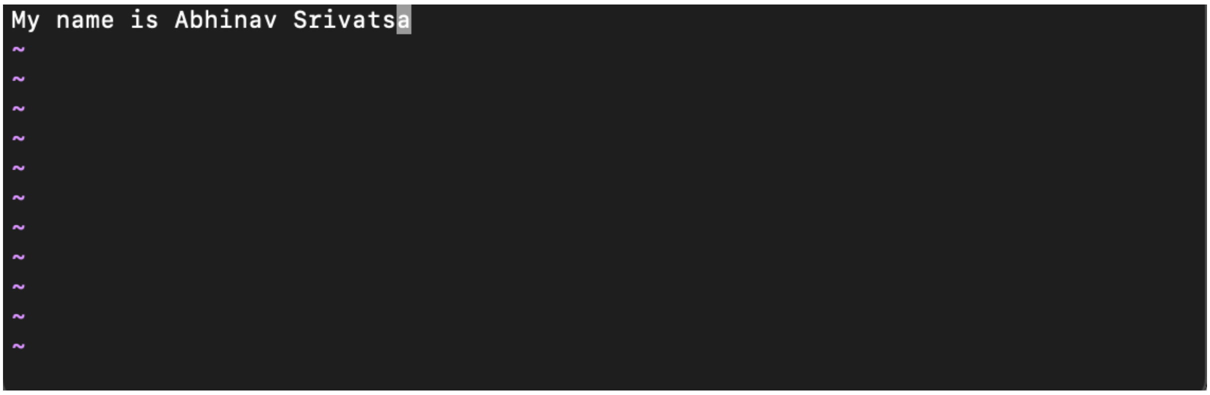
```
~
~
~
~
~
-- INSERT --
```

Can enter text now in insert mode:



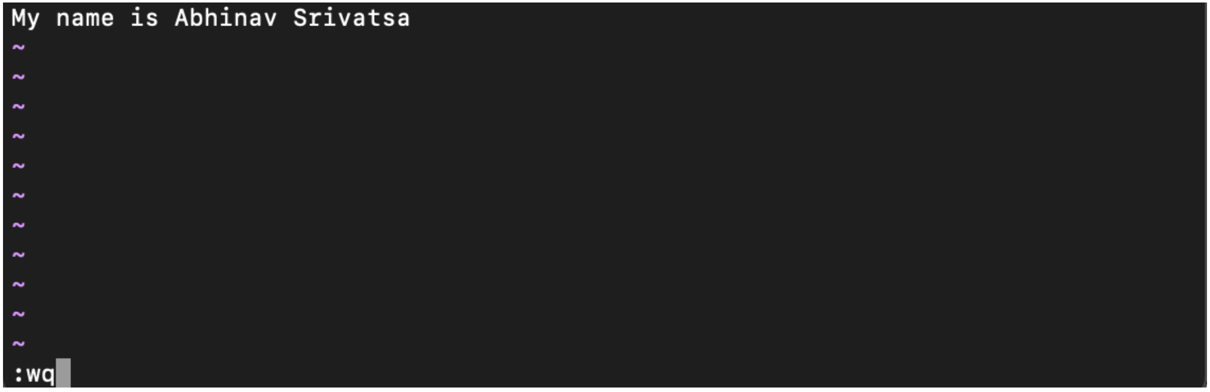
```
My name is Abhinav Srivatsa
~
~
~
~
~
~
~
~
~
~
~
-- INSERT --
```

Enter ESC to enter command mode:



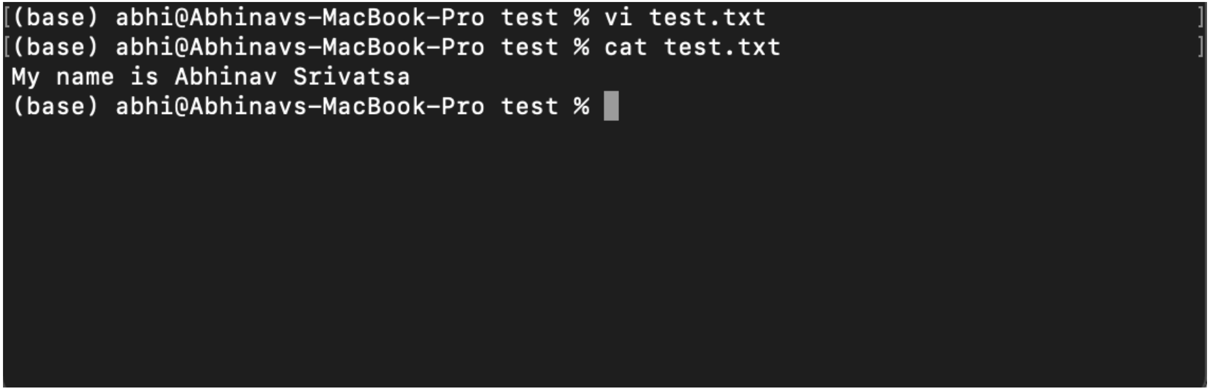
```
My name is Abhinav Srivatsa
~
~
~
~
~
~
~
~
~
~
~
```

Enter !wq to save and quit:



```
My name is Abhinav Srivatsa
~
~
~
~
~
~
~
~
~
~
~
:wq
```

Checking file:



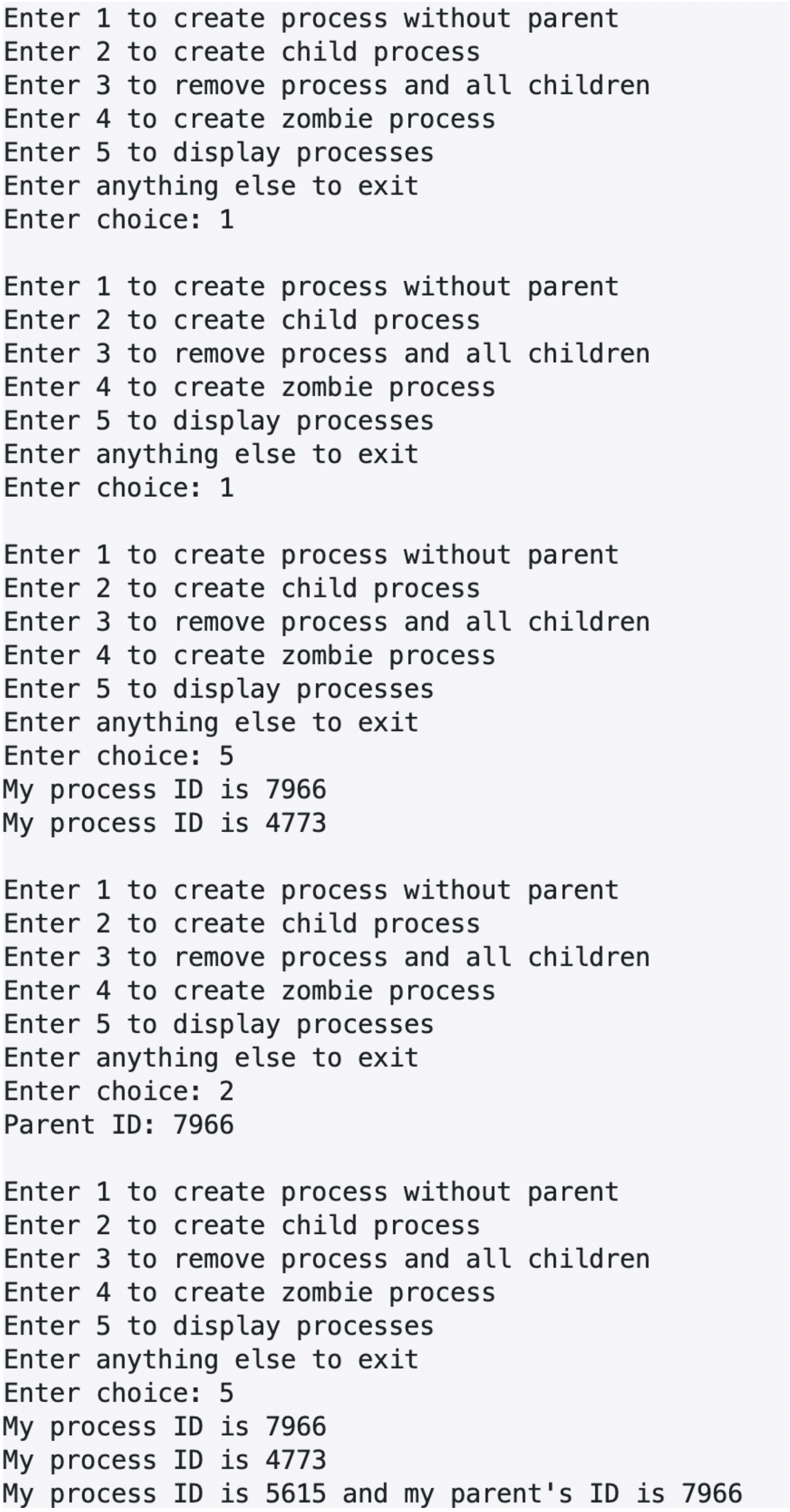
```
[(base) abhi@Abhinavs-MacBook-Pro test % vi test.txt
[(base) abhi@Abhinavs-MacBook-Pro test % cat test.txt
My name is Abhinav Srivatsa
(base) abhi@Abhinavs-MacBook-Pro test % 
```

Question 3

Code:

```
#include <iostream>
#include <cstdlib>
#include <time.h>
#include <stdbool.h>
using namespace std;

int getRandomId()
{
    srand(time(0));
    return rand() % 10000;
}

class Process
{
public:
    int id;
    Process *parent;
    bool sleeping;

    Process()
    {
        this->id = 0;
        this->parent = NULL;
        this->sleeping = false;
    }

    Process(int id)
    {
        this->id = id;
        this->parent = NULL;
        this->sleeping = false;
    }

    Process(int id, Process *parent)
    {
        this->id = id;
        this->parent = parent;
        this->sleeping = false;
    }
};

Process *createProcess()
{
    return new Process(getRandomId());
}

Process *fork(Process *parent)
{
    return new Process(getRandomId(), parent);
}

void remove(Process *process)
{
    free(process);
}

int main()
{
    int size = 50;
    Process *processes[size];

    int choice = 0;
    int i = 0;
    int parentId;
    bool flag = true;
    int id;
    while (flag)
    {
        cout << "Enter 1 to create process without parent\n";
        cout << "Enter 2 to create child process\n";
        cout << "Enter 3 to remove process and all children\n";
        cout << "Enter 4 to create zombie process\n";
        cout << "Enter 5 to display processes\n";
        cout << "Enter anything else to exit\n";
        cout << "Enter choice: ";
        cin >> choice;
        switch (choice)
        {
        case 1:
            processes[i++] = createProcess();
            break;

        case 2:
            cout << "Parent ID: ";
            cin >> parentId;
            Process *p;
            for (int x = 0; x < i; x++)
                if (processes[x]->id == parentId)
                    p = processes[x];
            processes[i++] = fork(p);
            break;

        case 3:
            cin >> parentId;
            for (int x = i - 1; x >= 0; x--)
                if (processes[x]->id == parentId || processes[x]->parent->id ==
parentId)
                {
                    remove(processes[x]);
                    processes[x] = new Process();
                }
            break;

        case 4:
            cin >> id;
            for (int x = 0; x < i; x++)
                if (processes[x]->id == id)
                    processes[x]->sleeping = true;
            break;

        case 5:
            for (int x = 0; x < i; x++)
            {
                if (processes[x]->id != 0)
                    cout << "My process ID is " << processes[x]->id;
                if (processes[x]->parent != NULL)
                    cout << " and my parent's ID is " << processes[x]->parent->id;
                if (processes[x]->sleeping)
                    cout << ", I am a zombie process";
                cout << "\n";
            }
            break;

        default:
            flag = false;
            break;
        }
        cout << "\n";
    }
}
```

Sample Output:



```
Enter 1 to create process without parent
Enter 2 to create child process
Enter 3 to remove process and all children
Enter 4 to create zombie process
Enter 5 to display processes
Enter anything else to exit
Enter choice: 1

Enter 1 to create process without parent
Enter 2 to create child process
Enter 3 to remove process and all children
Enter 4 to create zombie process
Enter 5 to display processes
Enter anything else to exit
Enter choice: 1

Enter 1 to create process without parent
Enter 2 to create child process
Enter 3 to remove process and all children
Enter 4 to create zombie process
Enter 5 to display processes
Enter anything else to exit
Enter choice: 5
My process ID is 7966
My process ID is 4773

Enter 1 to create process without parent
Enter 2 to create child process
Enter 3 to remove process and all children
Enter 4 to create zombie process
Enter 5 to display processes
Enter anything else to exit
Enter choice: 2
Parent ID: 7966

Enter 1 to create process without parent
Enter 2 to create child process
Enter 3 to remove process and all children
Enter 4 to create zombie process
Enter 5 to display processes
Enter anything else to exit
Enter choice: 5
My process ID is 7966
My process ID is 4773
My process ID is 5615 and my parent's ID is 7966
```