1.Caesar Cipher

```c
#include <stdio.h>
#include <string.h>

void encrypt(char message[], int key) {
    int i;
    char ch;
    for(i = 0; message[i] != '\0'; ++i) {
    ch = message[i];
    if(ch >= 'a' && ch <= 'z') {
            ch = ch + key;
            if(ch > 'z') {
            ch = ch - 26;
            }
            message[i] = ch;
    } else if(ch >= 'A' && ch <= 'Z') {
            ch = ch + key;
            if(ch > 'Z') {
            ch = ch - 26;
            }
            message[i] = ch;
    }
    }
}

void decrypt(char message[], int key) {
    int i;
    char ch;
    for(i = 0; message[i] != '\0'; ++i) {
```

```c
        ch = message[i];
        if(ch >= 'a' && ch <= 'z') {
                ch = ch - key;
                if(ch < 'a') {
                ch = ch + 26;
                }
                message[i] = ch;
        } else if(ch >= 'A' && ch <= 'Z') {
                ch = ch - key;
                if(ch < 'A') {
                ch = ch + 26;
                }
                message[i] = ch;
        }
        }
}

int main() {
    char message[100];
    int key, choice;

    printf("Enter a message: ");
    fgets(message, sizeof(message), stdin);
    message[strcspn(message, "\n")] = 0;

    printf("Enter key (0-25): ");
    scanf("%d", &key);

    key = key % 26;
```
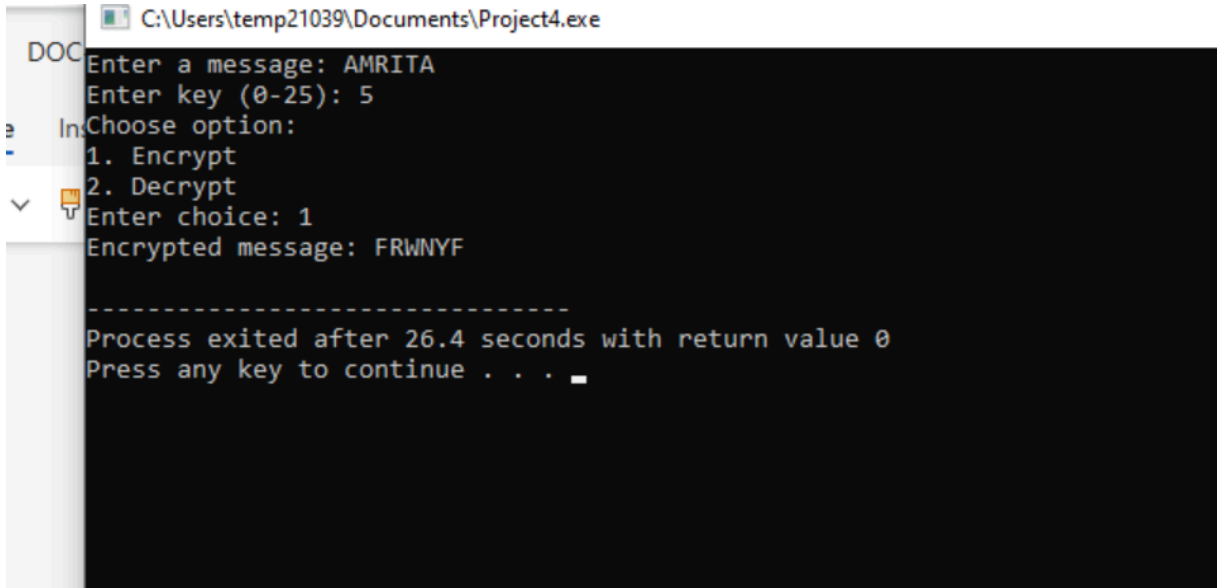
```c
printf("Choose option:\n1. Encrypt\n2. Decrypt\nEnter choice: ");
scanf("%d", &choice);

if(choice == 1) {
encrypt(message, key);
printf("Encrypted message: %s\n", message);
} else if(choice == 2) {
decrypt(message, key);
printf("Decrypted message: %s\n", message);
} else {
printf("Invalid choice.\n");
}

return 0;
}
```

Output:

Hill cipher

```c
#include <stdio.h>
#include <stdlib.h>

int main() {
    int a[10][10], b[10][10], mul[10][10];
    int r, i, j, k;
    int enc[10];  // This will hold the encrypted vector (e.g. one dimension)

    printf("Enter the size: ");
    scanf("%d", &r);

    printf("Enter the first matrix elements:\n");
    for (i = 0; i < r; i++) {
    for (j = 0; j < r; j++) {
        scanf("%d", &a[i][j]);  // Fix: pass address
    }
    }

    printf("Enter the second matrix elements:\n");
    for (i = 0; i < r; i++) {
    for (j = 0; j < 1; j++) {
        scanf("%d", &b[i][j]);  // Fix: pass address
    }
    }

    // Initialize mul matrix to zero
    for (i = 0; i < r; i++) {
    for (j = 0; j < r; j++) {
        mul[i][j] = 0;
```

```c
    }
    }


    // Matrix multiplication: mul = a * b
    for (i = 0; i < r; i++) {
    for (j = 0; j < 1; j++) {
        for (k = 0; k < r; k++) {
        mul[i][j] += a[i][k] * b[k][j];
        }
    }
    }


    // For encryption, assuming you want to mod each element of the
product matrix by 26
    printf("Encrypted matrix (each element mod 26):\n");
    for (i = 0; i < r; i++) {
    for (j = 0; j < 1; j++) {
        enc[j] = mul[i][j] % 26;  // Modulo 26 encryption on row i
        printf("%d\t", enc[j]);
    }
    printf("\n");
    }


    // Print original multiplication matrix without mod
    printf("\nMultiplied matrix:\n");
    for (i = 0; i < r; i++) {
    for (j = 0; j < 1; j++) {
        printf("%d\t", mul[i][j]);
    }
```

```c
        printf("\n");

        printf("encrypted text");
        for (i = 0; i < r; i++){
                printf("%d\t",enc[i]);
                printf("\n");
}
    }


    return 0;
}
```

Output
Enter the size: 3
Enter the first matrix elements:
6 24 1
13 16 10
20 17 15
Enter the second matrix elements:
0 2 19
Encrypted matrix (each element mod 26):
15
14
7

Multiplied matrix:
67
encrypted text7
0
128

```
Code
asas@ICTS-MYS-21038:~$ pwd
/home/asas
asas@ICTS-MYS-21038:~$ ls
abcd.c      Documents        ipclsc        p4.txt         tcpclientc
abcd.txt    Downloads        Lab3          p6.txt         tcpserverc
amrita      efgh.txt    linuxlabfile.txt  Pictures        Templates
amrita.txt f1.txt          mca           proc          UDPcleint.C
a.out       file10.txt      mca.c         product.txt   udpclientc
athul       file1.c         mca.txt            Public       udpclient.C
bca.txt     file1.txt       Music         read.sh       udpserverc
cars        file6.c         output.txt         rec          udpserver.C
course      fruits          p11.txt       shellscript  v.c
courses.txt  gadget.txt      p1.txt         snetc         Videos
cypher.C  gagan          p2.txt          student.txt
Desktop    'greater than.sh'  p3.txt          sum.sh
asas@ICTS-MYS-21038:~$ ls -l
total 236
-rw-rw-r-- 1 asas asas   608 Nov 14  2024  abcd.c
-rw-rw-r-- 1 asas asas   188 Sep 18  2024  abcd.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  amrita
-rw-rw-r-- 1 asas asas  79 Sep 18  2024  amrita.txt
-rwxrwxr-x 1 asas asas 16936 Aug 23 14:42  a.out
drwxrwxr-x 3 asas asas  4096 Sep  8 19:33  athul
-rw-rw-r-- 1 asas asas  85 Sep 18  2024  bca.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  cars
drwxrwxr-x 4 asas asas  4096 Oct  5  2024  course
-rw-rw-r-- 1 asas asas  83 May  7 16:44  courses.txt
-rw-rw-r-- 1 asas asas   456 Aug 23 15:47  cypher.C
```

```
drwxr-xr-x 3 asas asas  4096 May  7 16:42  Desktop
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Documents
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Downloads
-rw-rw-r-- 1 asas asas   188 Sep 18  2024  efgh.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  f1.txt
-rw-rw-r-- 1 asas asas  0 Oct 20  2024  file10.txt
-rw-rw-r-- 1 asas asas  0 Nov  9  2024  file1.c
-rw-rw-r-- 1 asas asas 24 Oct 20  2024  file1.txt
drwxrwxr-x 2 asas asas  4096 Nov  9  2024  file6.c
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  fruits
-rw-rw-r-- 1 asas asas   324 Oct 19  2024  gadget.txt
drwxrwxr-x 2 asas asas  4096 Nov  9  2024  gagan
-rw-rw-r-- 1 asas asas   133 Nov 13  2024 'greater than.sh'
-rw-rw-r-- 1 asas asas  3660 Aug 23 14:14  ipclsc
-rw-rw-r-- 1 asas asas   898 Aug 16 14:24  Lab3
-rw-rw-r-- 1 asas asas   151 Oct 16  2024  linuxlabfile.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  mca
-rw-rw-r-- 1 asas asas   177 Nov 14  2024  mca.c
-rw-rw-r-- 1 asas asas 87 Sep 18  2024  mca.txt
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Music
-rw-rw-r-- 1 asas asas 83 May  7 16:49  output.txt
-rw-rw-r-- 1 asas asas 85 Sep 18  2024  p11.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  p1.txt
-rw-rw-r-- 1 asas asas 75 Sep 18  2024  p2.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  p3.txt
drwxrwxr-x 2 asas asas  4096 Sep 18  2024  p4.txt
-rw-rw-r-- 1 asas asas 0 Sep 18  2024  p6.txt
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Pictures
-rw-rw-r-- 1 asas asas  1231 Aug 23 14:07  proc
-rw-rw-r-- 1 asas asas   471 Oct 19  2024  product.txt
```

```
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Public
-rw-rw-r-- 1 asas asas  53 Oct 23  2024  read.sh
-rw-rw-r-- 1 asas asas  1140 Aug 23 14:07  rec
drwxrwxr-x 2 asas asas  4096 Oct 26  2024  shellscript
-rw-rw-r-- 1 asas asas  2988 Aug 23 14:19  snetc
-rw-rw-r-- 1 asas asas   264 Oct 16  2024  student.txt
-rwxrwxr-x 1 asas asas       47 Oct 30  2024  sum.sh
-rw-rw-r-- 1 asas asas  1285 Aug 23 14:05  tcpclientc
-rw-rw-r-- 1 asas asas  1627 Aug 23 14:05  tcpserverc
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Templates
-rw-rw-r-- 1 asas asas   899 Aug 16 14:42  UDPcleint.C
-rw-rw-r-- 1 asas asas  1178 Aug 23 14:03  udpclientc
-rw-rw-r-- 1 asas asas   901 Aug 16 14:46  udpclient.C
-rw-rw-r-- 1 asas asas  1523 Aug 23 14:04  udpserverc
-rw-rw-r-- 1 asas asas  1164 Aug 16 14:46  udpserver.C
-rw-rw-r-- 1 asas asas   608 Nov 14  2024  v.c
drwxr-xr-x 2 asas asas  4096 Sep 11  2024  Videos
asas@ICTS-MYS-21038:~$ mkdir ss
asas@ICTS-MYS-21038:~$ ls ss
asas@ICTS-MYS-21038:~$ touch new.txt
asas@ICTS-MYS-21038:~$ pwd
/home/asas
asas@ICTS-MYS-21038:~$ cd/home/asas/ss
bash: cd/home/asas/ss: No such file or directory
asas@ICTS-MYS-21038:~$ cd /home/asas/ss
asas@ICTS-MYS-21038:~/ss$ touch word.txt
asas@ICTS-MYS-21038:~/ss$ gedit word.txt
asas@ICTS-MYS-21038:~/ss$ ls word.txt
word.txt
asas@ICTS-MYS-21038:~/ss$ ls -l  word.txt
```

-rw-rw-r-- 1 asas asas 9 Sep 12 17:16 word.txt

asas@ICTS-MYS-21038:~/ss$ cat word.txt

hello hi

asas@ICTS-MYS-21038:~/ss$ sudo chmod 700 word.txt

[sudo] password for asas:

asas is not in the sudoers file. This incident will be reported.

asas@ICTS-MYS-21038:~/ss$ sudo chmod 700 word.txt

[sudo] password for asas:

asas is not in the sudoers file. This incident will be reported.

asas@ICTS-MYS-21038:~/ss$ sudo chmod 700 word.txt

[sudo] password for asas:

asas is not in the sudoers file. This incident will be reported.

asas@ICTS-MYS-21038:~/ss$ sudo chmod 700 word.txt

[sudo] password for asas:

Sorry, try again.

[sudo] password for asas:

asas is not in the sudoers file. This incident will be reported.

asas@ICTS-MYS-21038:~/ss$ chmod 140 word.txt

asas@ICTS-MYS-21038:~/ss$ ls -l

total 4

---xr----- 1 asas asas 9 Sep 12 17:16 word.txt

asas@ICTS-MYS-21038:~/ss$ mkdir subdir

asas@ICTS-MYS-21038:~/ss$ ls -ld subdir

drwxrwxr-x 2 asas asas 4096 Sep 12 17:27 subdir

asas@ICTS-MYS-21038:~/ss$ chmod 777 subdir

asas@ICTS-MYS-21038:~/ss$ ls -ld

drwxrwxr-x 3 asas asas 4096 Sep 12 17:27 .

asas@ICTS-MYS-21038:~/ss$ sudo chmod 700 word.txt

asas@ICTS-MYS-21038:~/ss$ chmod 700 word.txt

sas@ICTS-MYS-21038:~/ss$ chmod o+r word.txt

asas@ICTS-MYS-21038:~/ss$ ls -l word.txt

-rwx---r-- 1 asas asas 9 Sep 12 17:16 word.txt

asas@ICTS-MYS-21038:~/ss$ chmod u+w word.txt

asas@ICTS-MYS-21038:~/ss$ ls -l word.txt

-rwx---r-- 1 asas asas 9 Sep 12 17:16 word.txt

asas@ICTS-MYS-21038:~/ss$ cd ...

bash: cd: ...: No such file or directory

asas@ICTS-MYS-21038:~/ss$ cd ..

asas@ICTS-MYS-21038:~$ cd ...

bash: cd: ...: No such file or directory

asas@ICTS-MYS-21038:~$ cd ..

asas@ICTS-MYS-21038:/home$ pwd

/home

asas@ICTS-MYS-21038:/home$ cd ..

asas@ICTS-MYS-21038:/$ ls

bin boot cdrom dev etc home lib lib32 lib64 libx32 lost+found media mnt opt proc root run sbin snap srv sys tmp usr var

19-09-25

Railfence

```
#include<stdio.h>
#include<string.h>
#include<stdlib.h>
main()
{
int i ,j ,len , rails,count,code[100][1000];
char str[1000];
printf("Enter the secret message:");
gets(str);
```

```c
len=strlen(str);
printf("enter the no of rails:");
scanf("%d",&rails);
for(i=0;i<rails;i++){
for(j=0;j<len;j++){
code[i][j]=0;

}
}
count==0;
j=0;
while(j<len){
if (count%2==0){
for(i=0;i<rails;i++){
code[i][j]=(int)str[j];
j++;
}
}
else{
for(i=rails-2;i>0;i--){
code[i][j]=(int)str[j];
j++;

}
}
for(i=0;i<rails;i++){
for(j=0;j<len;j++){
if (code[i][j]!=0)
printf("%c",code[i][j]);
```

```
}
}
printf("\n");
}}
```

Linux code [ownership file change]

```
asas@ICTS-MYS-021039:~$ mkdir -p lab/file
asas@ICTS-MYS-021039:~$ sudo chown -R root:root lab
[sudo] password for asas:
asas@ICTS-MYS-021039:~$ ls -ld lab
drwxrwxr-x 3 root root 4096 Sep 19 17:13 lab
asas@ICTS-MYS-021039:~$ cd lab
asas@ICTS-MYS-021039:~/lab$ ls -ld file
drwxrwxr-x 2 root root 4096 Sep 19 17:13 file
asas@ICTS-MYS-021039:~/lab$ cd ..
asas@ICTS-MYS-021039:~$ mkdir -p security/cyber
asas@ICTS-MYS-021039:~$ ls -ld
drwxr-xr-x 72 asas asas 4096 Sep 19 17:16 .
asas@ICTS-MYS-021039:~$ ls -ld security
drwxrwxr-x 3 asas asas 4096 Sep 19 17:16 security
asas@ICTS-MYS-021039:~$ sudo chown -R root:root security
asas@ICTS-MYS-021039:~$ ls -ld security
drwxrwxr-x 3 root root 4096 Sep 19 17:16 security
asas@ICTS-MYS-021039:~$ cd security
asas@ICTS-MYS-021039:~/security$ ls -ld cyber
drwxrwxr-x 2 root root 4096 Sep 19 17:16 cyber
asas@ICTS-MYS-021039:~/security$ sudo chown -R asas:asas cyber
asas@ICTS-MYS-021039:~/security$ ls -ld cyber
drwxrwxr-x 2 asas asas 4096 Sep 19 17:16 cyber
asas@ICTS-MYS-021039:~/security$ sudo touch file2.txt
```

asas@ICTS-MYS-021039:~/security$ ls -l

total 4

drwxrwxr-x 2 asas asas 4096 Sep 19 17:16 cyber

-rw-r--r-- 1 root root   0 Sep 19 17:25 file1.txt

-rw-r--r-- 1 root root   0 Sep 19 17:26 file2.txt

Username and password create

asas@ICTS-MYS-021039:~/security$ sudo useradd -m -s/bin/bash security

asas@ICTS-MYS-021039:~/security$ sudo passwd security

New password:

Retype new password:

passwd: password updated successfully

Giving time limit for password

asas@ICTS-MYS-021039:~/security$ sudo chage -M 90 -m 10 security

history

asas@ICTS-MYS-021039:~/security$ history

Hash

asas@ICTS-MYS-021039:~/security$ hash

hits command

  2 /usr/bin/mkdir

  9 /usr/bin/sudo

  3 /usr/bin/touch

  9 /usr/bin/ls

Update

asas@ICTS-MYS-021039:~/security$ sudo apt-get update

Gcc install

asas@ICTS-MYS-021039:~/security$ sudo apt-get install gcc

Reading package lists... Done

Building dependency tree

Reading state information... Done

gcc is already the newest version (4:9.3.0-1ubuntu2).

gcc set to manually installed.

The following packages were automatically installed and are no longer required:

  gir1.2-goa-1.0 libfwupdplugin1 libxmlb1

Use 'sudo apt autoremove' to remove them.

0 upgraded, 0 newly installed, 0 to remove and 211 not upgraded.

G++

asas@ICTS-MYS-021039:~/security$ sudo apt-get install g++

Reading package lists... Done

Building dependency tree

Reading state information... Done

g++ is already the newest version (4:9.3.0-1ubuntu2).

The following packages were automatically installed and are no longer required:

  gir1.2-goa-1.0 libfwupdplugin1 libxmlb1

Use 'sudo apt autoremove' to remove them.

0 upgraded, 0 newly installed, 0 to remove and 211 not upgraded.

In depth explanation of the owning or file change code done before

1. mkdir -p lab/file

- **Purpose: Creates a directory named lab and inside it, a directory named file.**

- **-p flag makes sure the parent directory (lab) is created if it doesn't exist.**

2. sudo chown -R root:root lab

- **Purpose: Changes the ownership of the lab directory and everything inside it (-R means recursive) to the user root and group root.**
- **sudo is needed because you are changing ownership to root.**

3. ls -ld lab

- **Purpose: Lists detailed information about the lab directory (not contents, just the directory itself).**
- **Output: drwxrwxr-x 3 root root 4096 Sep 19 17:13 lab**
  - **d means directory.**
  - **rwxrwxr-x are permissions (owner, group, others).**
  - **3 is the number of links.**
  - **root root means user and group owner.**
  - **4096 size in bytes.**
  - **Date and time.**
  - **lab is the directory name.**

4. cd lab

- **Purpose: Changes your current directory to lab.**

5. ls -ld file

- **Purpose: Lists details of the file directory inside lab.**
- **Shows similar info as above but for the file directory.**

6. cd ..

- **Purpose: Goes back to the parent directory (one level up).**

7. mkdir -p security/cyber

- **Purpose: Creates security directory and inside it cyber.**
- **If security doesn't exist, it is created due to -p.**

8. ls -ld

- **Purpose: Lists the current directory's details (denoted by .).**
- **Shows your current directory permissions, owner, etc.**

9. ls -ld security

- **Purpose: Shows detailed info of security directory.**

10. sudo chown -R root:root security

- **Purpose: Changes ownership of security directory and all inside it to user root and group root.**

11. ls -ld security

- **Purpose: Confirms ownership change for security.**

12. cd security

- **Purpose: Move inside the security directory.**

13. ls -ld cyber

- **Purpose: Lists details about the cyber directory.**

14. sudo chown -R asas:asas cyber

- **Purpose: Changes ownership of cyber directory and contents back to user asas and group asas.**

15. ls -ld cyber

- **Purpose: Confirm ownership change of cyber.**

16. sudo touch file2.txt

- **Purpose: Creates an empty file named file2.txt with root ownership (because of sudo).**
- **If the file exists, it updates the timestamp.**

17. ls -l

- **Purpose: Lists all files and directories with detailed info in current directory (security).**
- **Output shows:**
    - **cyber directory owned by asas.**
    - **file1.txt and file2.txt are root-owned files.**

26th September 2025

- **sudo apt update**

- **ns3@ICTS-MYS-021039:~$ sudo ufw enable**

Firewall is active and enabled on system startup

- **ns3@ICTS-MYS-021039:~$ sudo ufw allow 22/tcp**

Rule added

Rule added (v6)

- **ns3@ICTS-MYS-021039:~$ sudo ufw allow http**

Rule added

Rule added (v6)

- **ns3@ICTS-MYS-021039:~$ sudo ufw status verbose**

Status: active

Logging: on (low)

Default: deny (incoming), allow (outgoing), disabled (routed)

New profiles: skip

To	Action	From
22/tcp	ALLOW IN	Anywhere
80/tcp	ALLOW IN	Anywhere
22/tcp (v6)	ALLOW IN	Anywhere (v6)
80/tcp (v6)	ALLOW IN	Anywhere (v6)

- **ns3@ICTS-MYS-021039:~$ sudo nmap -sn 192.168.1.0/24**
  Starting Nmap 7.80 (https://nmap.org) at 2025-09-26 09:28 IST
  Nmap done: 256 IP addresses (0 hosts up) scanned in 206.34 seconds

- **ns3@ICTS-MYS-021039:~$ nmap -Pn -p 80 192.168.1.1**
  Starting Nmap 7.80 (https://nmap.org) at 2025-09-26 09:35 IST
  Nmap scan report for 192.168.1.1
  Host is up.

  PORT   STATE   SERVICE
  80/tcp filtered http

Nmap done: 1 IP address (1 host up) scanned in 2.58 seconds

- **s3@ICTS-MYS-021039:~$ nmap -Pn -p 80,443 192.168.1.1**
  Starting Nmap 7.80 (https://nmap.org) at 2025-09-26 09:37 IST
  Nmap scan report for 192.168.1.1
  Host is up.

  PORT   STATE   SERVICE
  80/tcp filtered http
  443/tcp filtered https

  Nmap done: 1 IP address (1 host up) scanned in 3.07 seconds

- **ns3@ICTS-MYS-021039:~$ sudo tcpdump**
  [sudo] password for ns3:
  tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
  listening on eno1, link-type EN10MB (Ethernet), capture size 262144 bytes
  09:47:17.024247 STP 802.1w, Rapid STP, Flags [Learn, Forward, Agreement], bridge-id 8000.00:7e:95:54:0e:fc.8007, length 51
  09:47:17.503656 IP ICTS-MYS-021039.51766 > bom12s21-in-f10.1e100.net.https: Flags [P.], seq 3033955457:3033955496, ack 537698499, win 501, options [nop,nop,TS val 1168125644 ecr 1990306540], length 39
  09:47:17.505157 IP ICTS-MYS-021039.58499 > dns.google.domain: 6413+ [1au] PTR? 74.42.251.142.in-addr.arpa. (55)
  09:47:17.523357 IP bom12s21-in-f10.1e100.net.https > ICTS-MYS-021039.51766: Flags [P.], seq 1:40, ack 39, win 1044, options [nop,nop,TS val 1990364832 ecr 1168125644], length 39

```
^C
170 packets captured
170 packets received by filter
0 packets dropped by kernel
```

26th September 2025

01) odd even, positive negative

```bash
#!/bin/bash
read -p "Enter a number: " number
if (( number > 0 )); then
        echo -n "The number is positive"
        if (( number % 2 == 0 )); then
        echo " and even."
        else
        echo " and odd."
        fi
elif (( number < 0 )); then
        echo -n "The number is negative"
        if (( number % 2 == 0 )); then
        echo " and even."
        else
        echo " and odd."
        fi
else
        echo "The number is zero (and is considered even)."
fi
```

```
ns3@ICTS-MYS-21037:~$ bash fl.sh
Enter a number: 8
The number is positive and even.
```

ns3@ICTS-MYS-21037:~$ bash fl.sh

Enter a number: 8

The number is positive and even.

02)

```bash
#!/bin/bash
read -p "Enter the number of Fibonacci terms: " total
x=0
y=1
echo "Fibonacci series up to $total terms:"
if (( total == 0 )); then
        echo "No terms to display."
        exit 0
fi
echo -n "$x"
if (( total == 1 )); then
        echo ""
        exit 0
fi
echo -n " $y"
for (( i=2; i<total; i++ )); do
        z=$((x + y))
        echo -n " $z"
        x=$y
        y=$z
done
echo ""
```

ns3@ICTS-MYS-21037:~$ bash fl.sh

Enter the number of Fibonacci terms: 12

Fibonacci series up to 12 terms:

0 1 1 2 3 5 8 13 21 34 55 89

ns3@ICTS-MYS-21037:~$ bash fl.sh

Enter the number of Fibonacci terms: 50

Fibonacci series up to 50 terms:

0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181 6765 10946 17711 28657 46368 75025 121393 196418 317811 514229 832040 1346269 2178309 3524578 5702887 9227465 14930352 24157817 39088169 63245986 102334155 165580141 267914296 433494437 701408733 1134903170 1836311903 2971215073 4807526976 7778742049

For Numeric Comparisons:

- **-eq: Equal to. Checks if two numeric values are equal.**
- **-ne: Not equal to. Checks if two numeric values are not equal.**
- **-gt: Greater than. Checks if the first numeric value is greater than the second.**

For String Comparisons:

- **= or ==: Equal to. Checks if two strings are identical.**
- **!=: Not equal to. Checks if two strings are not identical.**
- **<: Less than. Checks if the first string is alphabetically less than the second. (Note: Requires [[...]] for proper string comparison).**
- **>: Greater than. Checks if the first string is alphabetically greater than the second. (Note: Requires [[...]] for proper string comparison).**

-ge: Greater than or equal to. Checks if the first numeric value is greater than or equal to the second.

-lt: Less than. Checks if the first numeric value is less than the second.

-le: Less than or equal to. Checks if the first numeric value is less than or equal to the second.

03)

```bash
#!/bin/bash
echo "Enter the first number:"
read num1
echo "Enter the second number:"
read num2

echo "Select an operation:"
echo "1. Addition (+)"
echo "2. Subtraction (-)"
echo "3. Multiplication (*)"
echo "4. Division (/)"
read -p "Enter your choice (1-4): " choice

choice=$(printf "%s" "$choice" | tr -d '\r')

case $choice in
    1)
    result=$((num1 + num2))
    echo "The sum is: $result"
    ;;
    2)
    result=$((num1 - num2))
```

```bash
        echo "The difference is: $result"
        ;;
        3)
        result=$((num1 * num2))
        echo "The product is: $result"
        ;;
        4)
        if [ "$num2" -eq 0 ]; then
        echo "Error: Division by zero is not allowed."
        else
        result=$((num1 / num2))
        echo "The quotient is: $result"
        fi
        ;;
        *)
        echo "Invalid choice. Please enter a number from 1 to 4."
        ;;
esac
```