Assignment 1

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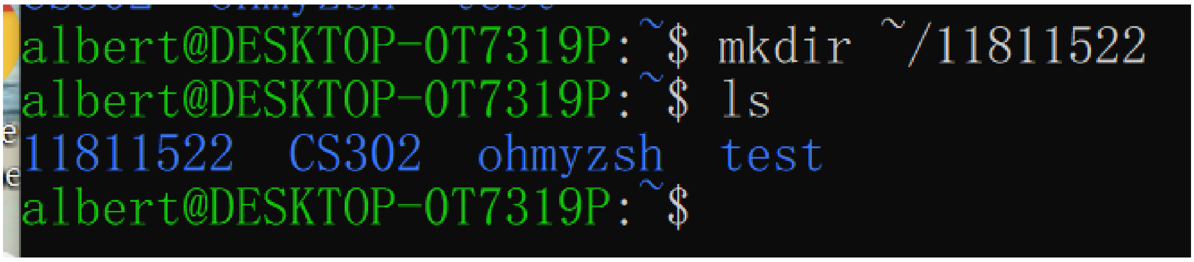
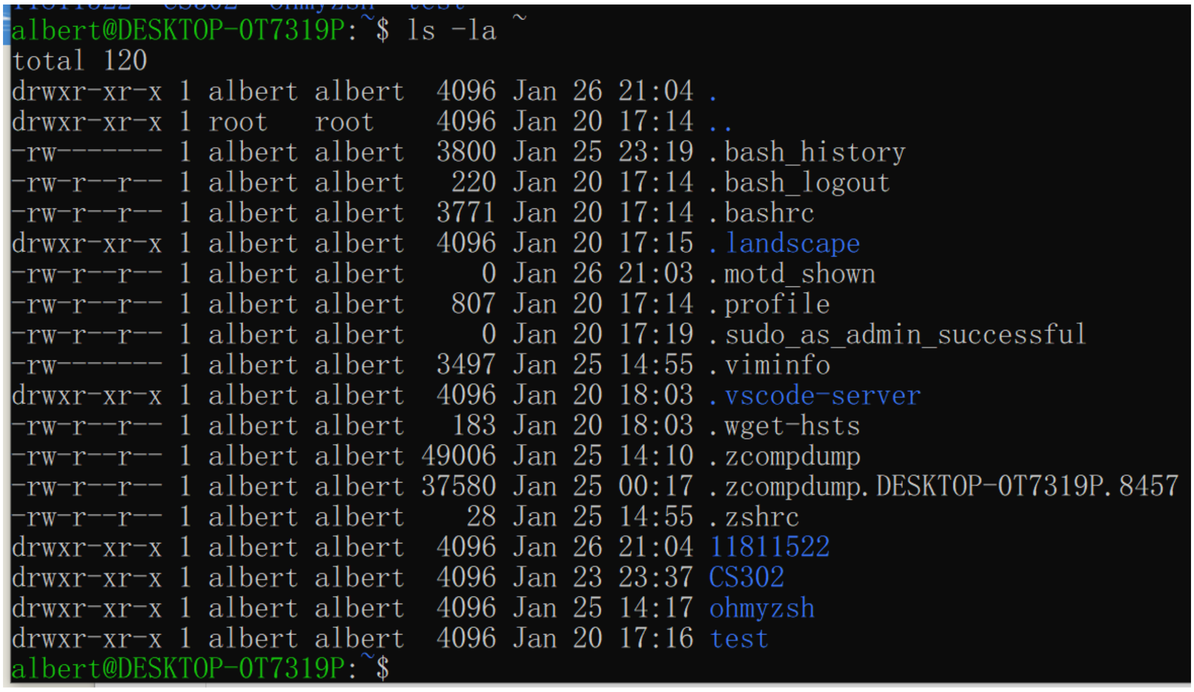
11811522

Q 1



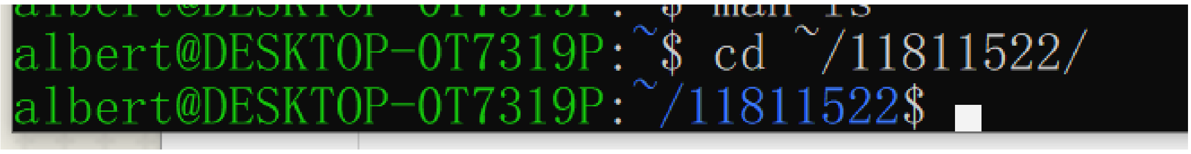
```
CS302  ohmyzsh  test
albert@DESKTOP-0T7319P:~$ mkdir ~/11811522
albert@DESKTOP-0T7319P:~$ ls
11811522  CS302  ohmyzsh  test
albert@DESKTOP-0T7319P:~$
```

Q 2



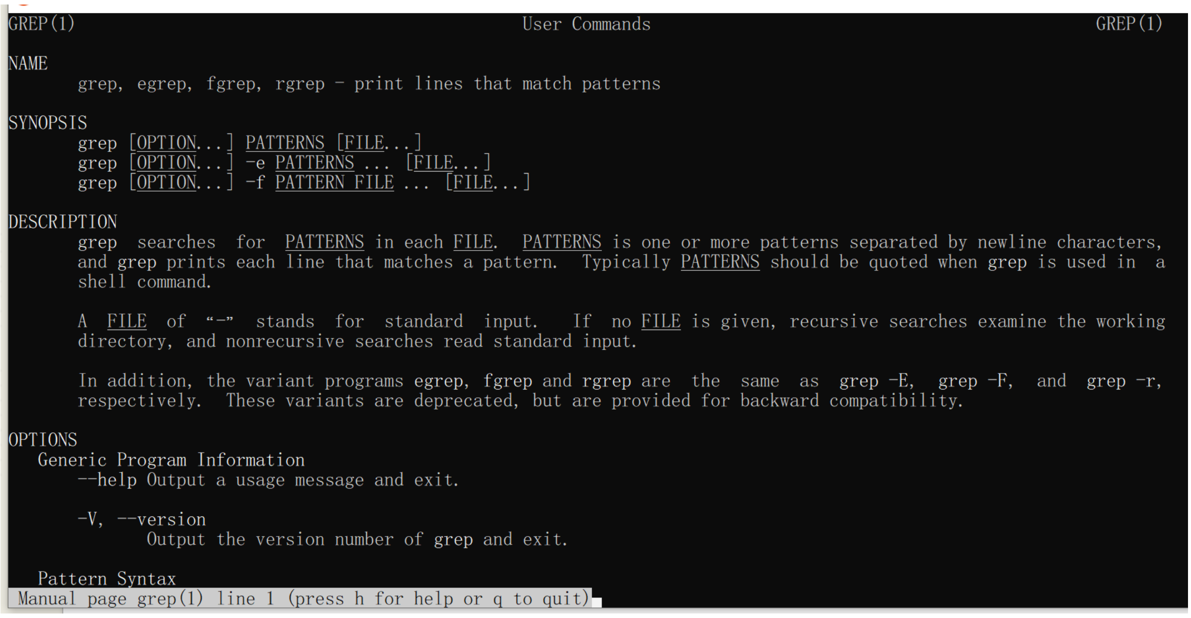
```
11811522  CS302  ohmyzsh  test
albert@DESKTOP-0T7319P:~$ ls -la ~
total 120
drwxr-xr-x 1 albert albert  4096 Jan 26 21:04 .
drwxr-xr-x 1 root   root    4096 Jan 20 17:14 ..
-rw------- 1 albert albert  3800 Jan 25 23:19 .bash_history
-rw-r--r-- 1 albert albert   220 Jan 20 17:14 .bash_logout
-rw-r--r-- 1 albert albert  3771 Jan 20 17:14 .bashrc
drwxr-xr-x 1 albert albert  4096 Jan 20 17:15 .landscape
-rw-r--r-- 1 albert albert     0 Jan 26 21:03 .motd_shown
-rw-r--r-- 1 albert albert   807 Jan 20 17:14 .profile
-rw-r--r-- 1 albert albert     0 Jan 20 17:19 .sudo_as_admin_successful
-rw------- 1 albert albert  3497 Jan 25 14:55 .viminfo
drwxr-xr-x 1 albert albert  4096 Jan 20 18:03 .vscode-server
-rw-r--r-- 1 albert albert   183 Jan 20 18:03 .wget-hsts
-rw-r--r-- 1 albert albert 49006 Jan 25 14:10 .zcompdump
-rw-r--r-- 1 albert albert 37580 Jan 25 00:17 .zcompdump.DESKTOP-0T7319P.8457
-rw-r--r-- 1 albert albert    28 Jan 25 14:55 .zshrc
drwxr-xr-x 1 albert albert  4096 Jan 26 21:04 11811522
drwxr-xr-x 1 albert albert  4096 Jan 23 23:37 CS302
drwxr-xr-x 1 albert albert  4096 Jan 25 14:17 ohmyzsh
drwxr-xr-x 1 albert albert  4096 Jan 20 17:16 test
albert@DESKTOP-0T7319P:~$
```

Q 3



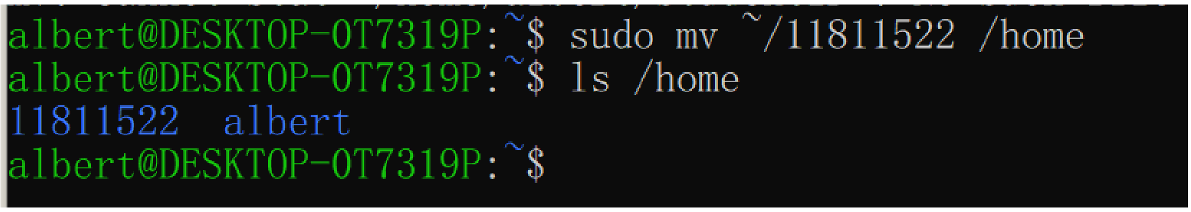
```
albert@DESKTOP-0T7319P:~$ man ls
albert@DESKTOP-0T7319P:~$ cd ~/11811522/
albert@DESKTOP-0T7319P:~/11811522$
```

Q 4



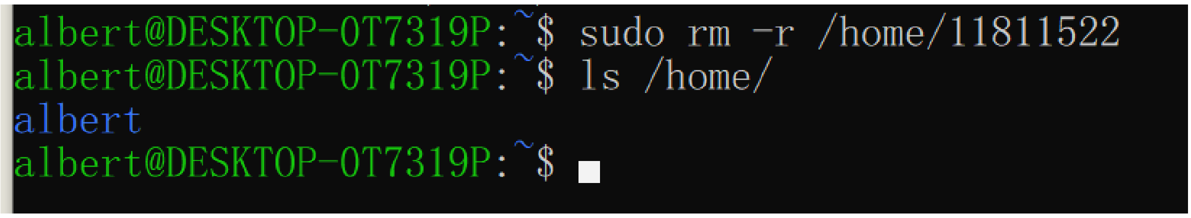
```
GREP(1)                          User Commands                          GREP(1)

NAME
       grep, egrep, fgrep, rgrep - print lines that match patterns

SYNOPSIS
       grep [OPTION...] PATTERNS [FILE...]
       grep [OPTION...] -e PATTERNS ... [FILE...]
       grep [OPTION...] -f PATTERN_FILE ... [FILE...]

DESCRIPTION
       grep  searches  for  PATTERNS in each FILE.  PATTERNS is one or more patterns separated by newline characters,
       and grep prints each line that matches a pattern.  Typically PATTERNS should be quoted when grep is used in  a
       shell command.

       A  FILE  of  "-"  stands  for  standard  input.   If  no FILE is given, recursive searches examine the working
       directory, and nonrecursive searches read standard input.

       In addition, the variant programs egrep, fgrep and rgrep are  the  same  as  grep -E,  grep -F,  and  grep -r,
       respectively.  These variants are deprecated, but are provided for backward compatibility.

OPTIONS
   Generic Program Information
       --help Output a usage message and exit.

       -V, --version
              Output the version number of grep and exit.

   Pattern Syntax
 Manual page grep(1) line 1 (press h for help or q to quit)
```

Q 5



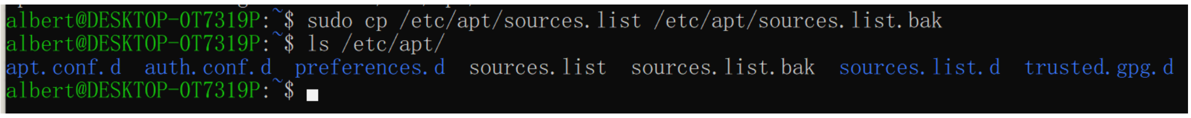
```
albert@DESKTOP-0T7319P:~$ sudo mv ~/11811522 /home
albert@DESKTOP-0T7319P:~$ ls /home
11811522  albert
albert@DESKTOP-0T7319P:~$
```

Q 6



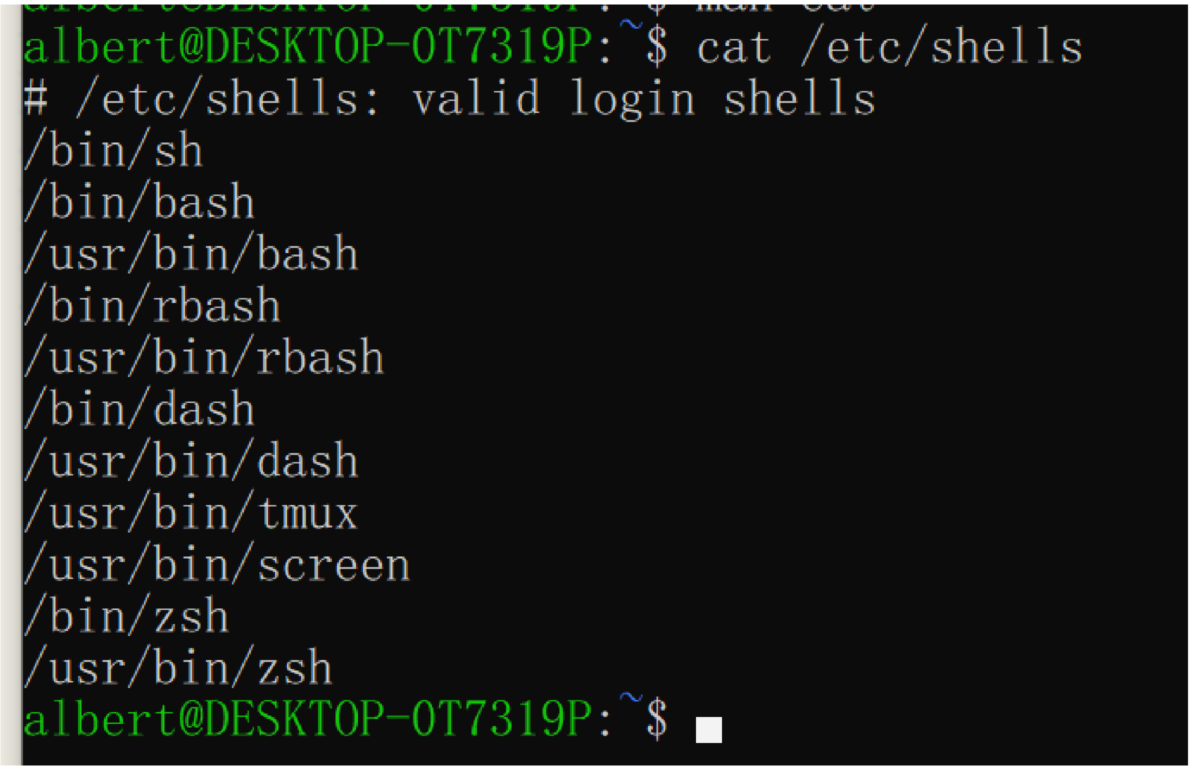
```
albert@DESKTOP-0T7319P:~$ sudo rm -r /home/11811522
albert@DESKTOP-0T7319P:~$ ls /home/
albert
albert@DESKTOP-0T7319P:~$
```

Q 7



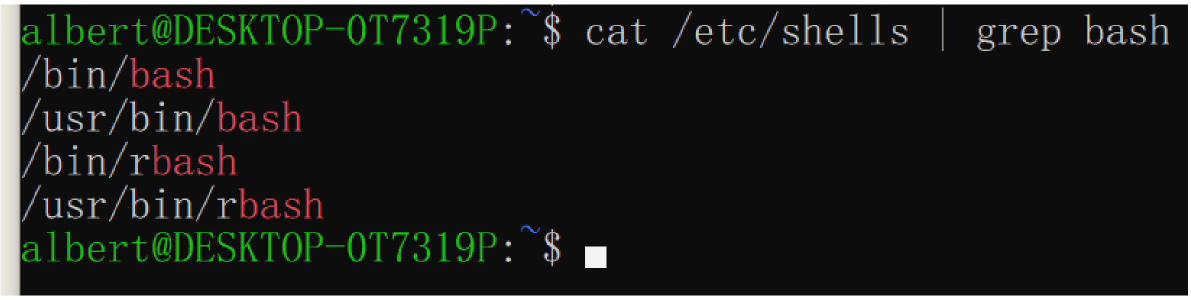
```
albert@DESKTOP-0T7319P:~$ sudo cp /etc/apt/sources.list /etc/apt/sources.list.bak
albert@DESKTOP-0T7319P:~$ ls /etc/apt/
apt.conf.d  auth.conf.d  preferences.d  sources.list  sources.list.bak  sources.list.d  trusted.gpg.d
albert@DESKTOP-0T7319P:~$
```

Q 8



```
albert@DESKTOP-0T7319P:~$ cat /etc/shells
# /etc/shells: valid login shells
/bin/sh
/bin/bash
/usr/bin/bash
/bin/rbash
/usr/bin/rbash
/bin/dash
/usr/bin/dash
/usr/bin/tmux
/usr/bin/screen
/bin/zsh
/usr/bin/zsh
albert@DESKTOP-0T7319P:~$
```

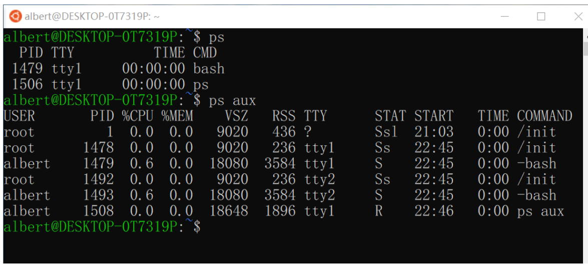
Q 9



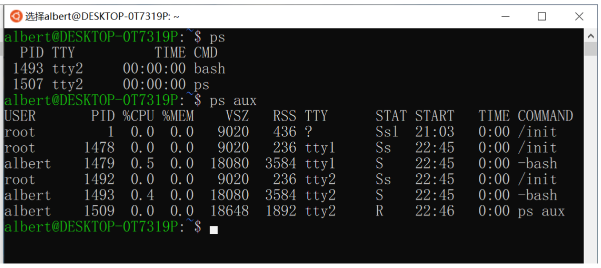
```
albert@DESKTOP-0T7319P:~$ cat /etc/shells | grep bash
/bin/bash
/usr/bin/bash
/bin/rbash
/usr/bin/rbash
albert@DESKTOP-0T7319P:~$
```

Q 10

`ps aux`

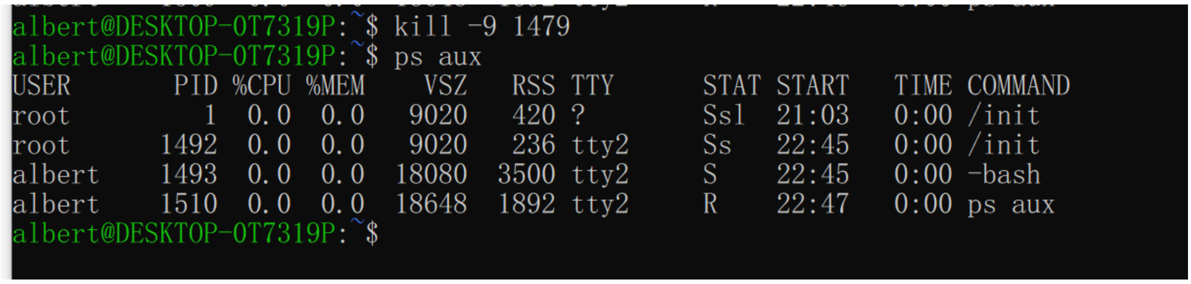


```
albert@DESKTOP-0T7319P:~$ ps
  PID TTY          TIME CMD
 1479 tty1     00:00:00 bash
 1506 tty1     00:00:00 ps
albert@DESKTOP-0T7319P:~$ ps aux
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.0   9020   436 ?        Ssl  21:03   0:00 /init
root      1478  0.0  0.0   9020   236 tty1     Ss   22:45   0:00 /init
albert    1479  0.6  0.0  18080  3584 tty1     S    22:45   0:00 -bash
root      1492  0.0  0.0   9020   236 tty2     Ss   22:45   0:00 /init
albert    1493  0.6  0.0  18080  3584 tty2     S    22:45   0:00 -bash
albert    1508  0.0  0.0  18648  1896 tty1     R    22:46   0:00 ps aux
albert@DESKTOP-0T7319P:~$
```



```
albert@DESKTOP-0T7319P:~$ ps
  PID TTY          TIME CMD
 1493 tty2     00:00:00 bash
 1507 tty2     00:00:00 ps
albert@DESKTOP-0T7319P:~$ ps aux
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.0   9020   436 ?        Ssl  21:03   0:00 /init
root      1478  0.0  0.0   9020   236 tty1     Ss   22:45   0:00 /init
albert    1479  0.5  0.0  18080  3584 tty1     S    22:45   0:00 -bash
root      1492  0.0  0.0   9020   236 tty2     Ss   22:45   0:00 /init
albert    1493  0.4  0.0  18080  3584 tty2     S    22:45   0:00 -bash
albert    1509  0.0  0.0  18648  1892 tty2     R    22:46   0:00 ps aux
albert@DESKTOP-0T7319P:~$
```

`kill -9 1479`



```
albert@DESKTOP-0T7319P:~$ kill -9 1479
albert@DESKTOP-0T7319P:~$ ps aux
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.0   9020   420 ?        Ssl  21:03   0:00 /init
root      1492  0.0  0.0   9020   236 tty2     Ss   22:45   0:00 /init
albert    1493  0.0  0.0  18080  3500 tty2     S    22:45   0:00 -bash
albert    1510  0.0  0.0  18648  1892 tty2     R    22:47   0:00 ps aux
albert@DESKTOP-0T7319P:~$
```

Q 11

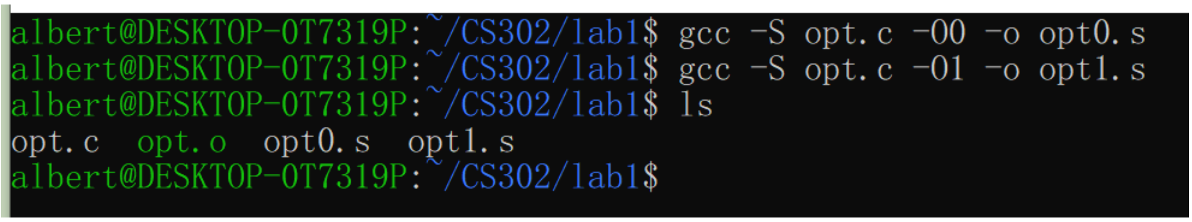
source code

opt.c

```c
#include<stdio.h>

int main(){
    int x = 0;
    x += 1;
    x += 1;
    x += 1;
    printf("%d\n", x);
    return 0;
}

```

Declare the variable x, add it to 1 three times, and then print it

command



```
albert@DESKTOP-0T7319P:~/CS302/lab1$ gcc -S opt.c -O0 -o opt0.s
albert@DESKTOP-0T7319P:~/CS302/lab1$ gcc -S opt.c -O1 -o opt1.s
albert@DESKTOP-0T7319P:~/CS302/lab1$ ls
opt.c  opt.o  opt0.s  opt1.s
albert@DESKTOP-0T7319P:~/CS302/lab1$
```

result

Compile the source files and generate two assembly files named "opt0.s" and "opt1.s"

opt0.s

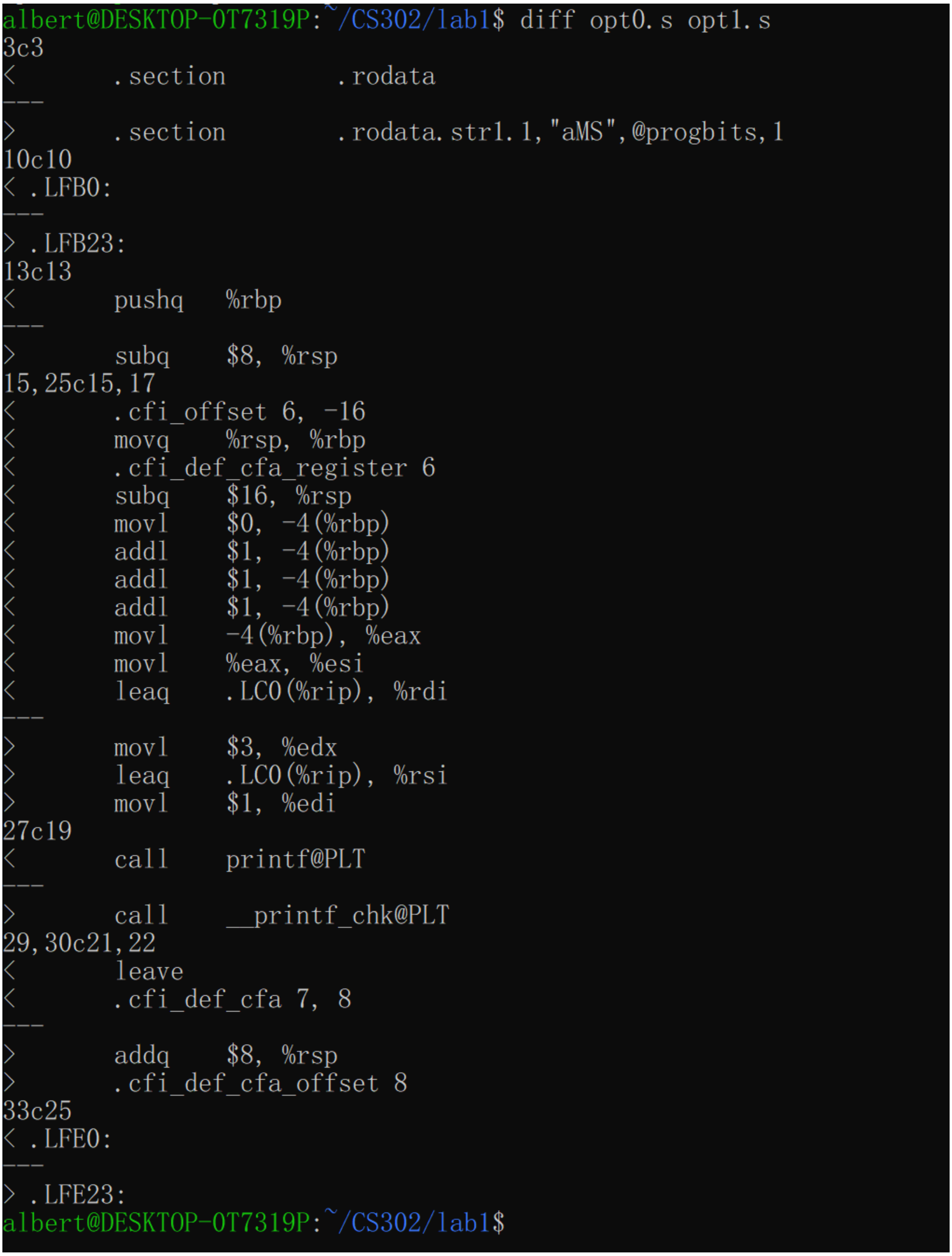
```
	.file	"opt.c"
	.text
	.section	.rodata
.LC0:
	.string "%d\n"
	.text
	.globl	main
	.type	main, @function
main:
.LFB0:
	.cfi_startproc
	endbr64
	pushq	%rbp
	.cfi_def_cfa_offset 16
	.cfi_offset 6, -16
	movq	%rsp, %rbp
	.cfi_def_cfa_register 6
	subq	$16, %rsp
	movl	$0, -4(%rbp)
	addl	$1, -4(%rbp)
	addl	$1, -4(%rbp)
	addl	$1, -4(%rbp)
	movl	-4(%rbp), %eax
	movl	%eax, %esi
```

```
    leaq    .LC0(%rip), %rdi
    movl    $0, %eax
    call    printf@PLT
    movl    $0, %eax
    leave
    .cfi_def_cfa 7, 8
    ret
    .cfi_endproc
.LFE0:
    .size   main, .-main
    .ident  "GCC: (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3.0"
    .section    .note.GNU-stack,"",@progbits
    .section    .note.gnu.property,"a"
    .align 8
    .long    1f - 0f
    .long    4f - 1f
    .long    5
0:
    .string  "GNU"
1:
    .align 8
    .long    0xc0000002
    .long    3f - 2f
2:
    .long    0x3
3:
    .align 8
4:

```

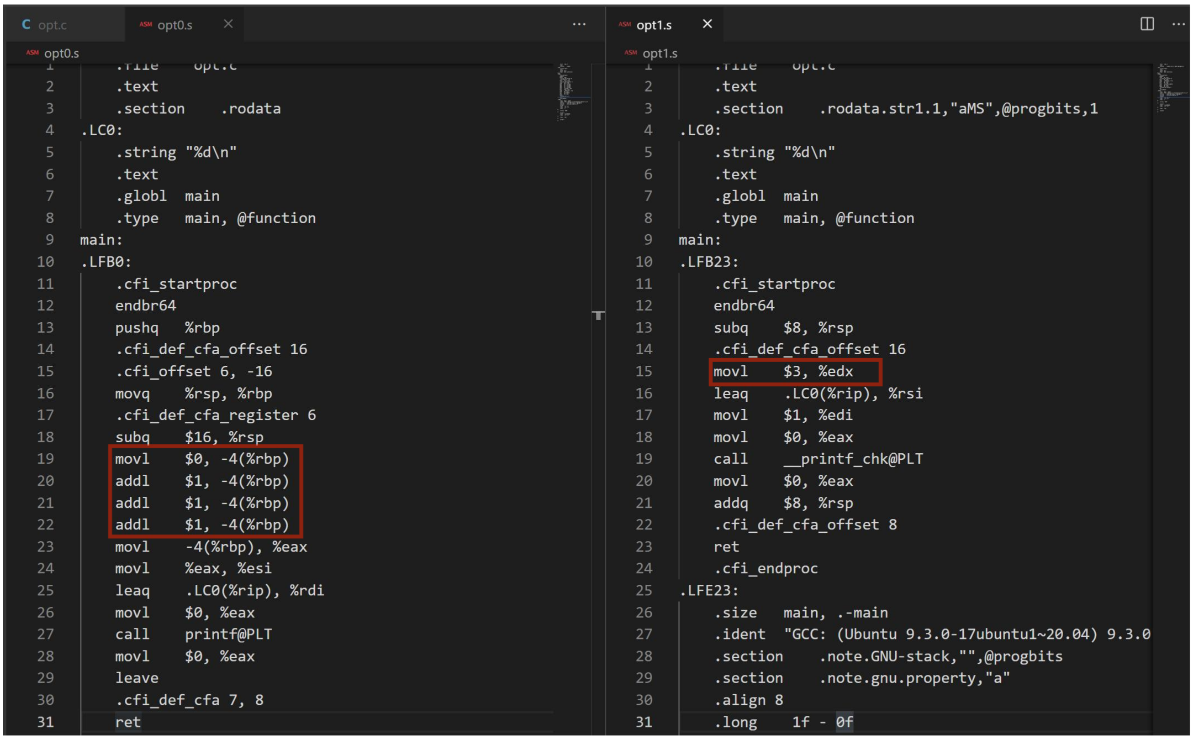
opt1.s

```
    .file   "opt.c"
    .text
    .section    .rodata.str1.1,"aMS",@progbits,1
.LC0:
    .string "%d\n"
    .text
    .globl  main
    .type   main, @function
main:
.LFB23:
    .cfi_startproc
    endbr64
    subq    $8, %rsp
    .cfi_def_cfa_offset 16
    movl    $3, %edx
    leaq    .LC0(%rip), %rsi
    movl    $1, %edi
    movl    $0, %eax
    call    __printf_chk@PLT
    movl    $0, %eax
    addq    $8, %rsp
    .cfi_def_cfa_offset 8
    ret
    .cfi_endproc
.LFE23:
    .size   main, .-main
    .ident  "GCC: (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3.0"
    .section    .note.GNU-stack,"",@progbits
    .section    .note.gnu.property,"a"
    .align 8
    .long    1f - 0f
    .long    4f - 1f
    .long    5
0:
    .string  "GNU"
1:
    .align 8
    .long    0xc0000002
    .long    3f - 2f
2:
    .long    0x3
3:
    .align 8
4:

```

difference



```
albert@DESKTOP-0T7319P:~/CS302/lab1$ diff opt0.s opt1.s
3c3
<       .section        .rodata
---
>       .section        .rodata.str1.1,"aMS",@progbits,1
10c10
< .LFB0:
---
> .LFB23:
13c13
<       pushq   %rbp
---
>       subq    $8, %rsp
15,25c15,17
<       .cfi_offset 6, -16
<       movq    %rsp, %rbp
<       .cfi_def_cfa_register 6
<       subq    $16, %rsp
<       movl    $0, -4(%rbp)
<       addl    $1, -4(%rbp)
<       addl    $1, -4(%rbp)
<       addl    $1, -4(%rbp)
<       movl    -4(%rbp), %eax
<       movl    %eax, %esi
<       leaq    .LC0(%rip), %rdi
---
>       movl    $3, %edx
>       leaq    .LC0(%rip), %rsi
>       movl    $1, %edi
27c19
<       call    printf@PLT
---
>       call    __printf_chk@PLT
29,30c21,22
<       leave
<       .cfi_def_cfa 7, 8
---
>       addq    $8, %rsp
>       .cfi_def_cfa_offset 8
33c25
< .LFE0:
---
> .LFE23:
albert@DESKTOP-0T7319P:~/CS302/lab1$
```



```
opt0.s
    .file   "opt.c"
    .text
    .section    .rodata
.LC0:
    .string "%d\n"
    .text
    .globl  main
    .type   main, @function
main:
.LFB0:
    .cfi_startproc
    endbr64
    pushq   %rbp
    .cfi_def_cfa_offset 16
    .cfi_offset 6, -16
    movq    %rsp, %rbp
    .cfi_def_cfa_register 6
    subq    $16, %rsp
    movl    $0, -4(%rbp)
    addl    $1, -4(%rbp)
    addl    $1, -4(%rbp)
    addl    $1, -4(%rbp)
    movl    -4(%rbp), %eax
    movl    %eax, %esi
    leaq    .LC0(%rip), %rdi
    movl    $0, %eax
    call    printf@PLT
    movl    $0, %eax
    leave
    .cfi_def_cfa 7, 8
    ret
```

```
opt1.s
    .file   "opt.c"
    .text
    .section    .rodata.str1.1,"aMS",@progbits,1
.LC0:
    .string "%d\n"
    .text
    .globl  main
    .type   main, @function
main:
.LFB23:
    .cfi_startproc
    endbr64
    subq    $8, %rsp
    .cfi_def_cfa_offset 16
    movl    $3, %edx
    leaq    .LC0(%rip), %rsi
    movl    $1, %edi
    movl    $0, %eax
    call    __printf_chk@PLT
    movl    $0, %eax
    addq    $8, %rsp
    .cfi_def_cfa_offset 8
    ret
    .cfi_endproc
.LFE23:
    .size   main, .-main
    .ident  "GCC: (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3.0
    .section    .note.GNU-stack,"",@progbits
    .section    .note.gnu.property,"a"
    .align 8
    .long    1f - 0f
```

“opt0.s”: The compiler did not optimize the code and repeated the addition three times as the source code did

“opt1.s”: The compiler performs partial compilation optimizations on the program, attempting to reduce the size of the generated code. So the compiler combines the cubic addition instruction into a single instruction

Conclusion

Through this task, I mastered the basic instructions of shell and understood the compilation process of C file