DEVICE DRIVERS LAB 3

DONE BY:
A S V DHANUSH
CS20B1057

1)HELLO WORLD PROGRAM (PROGRAM-1)

hello_world.c

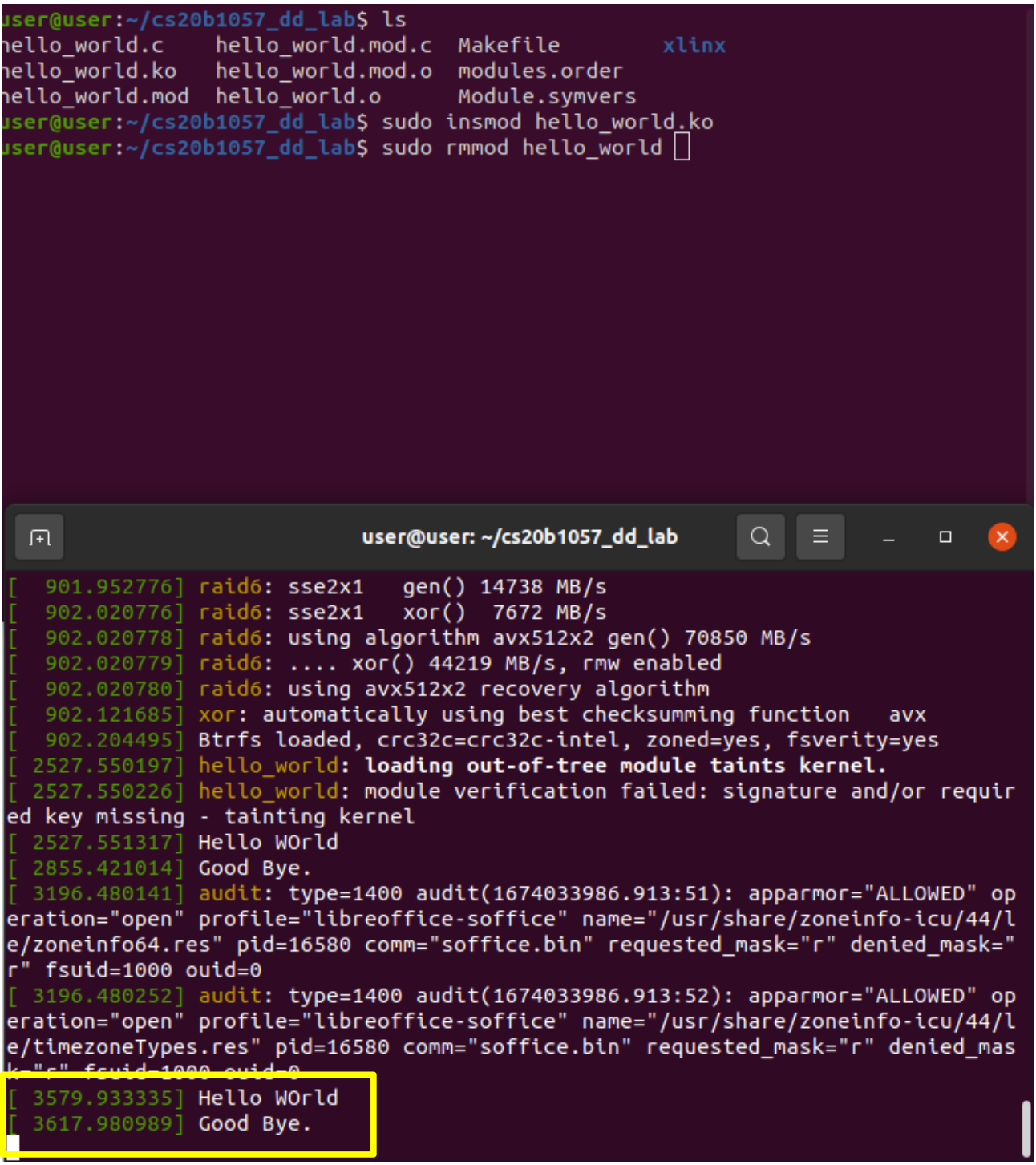
hello_world.c

```c
#include<linux/module.h>
#include<linux/kernel.h>
#include<linux/init.h>
MODULE_LICENSE("GPL");
MODULE_AUTHOR("DHANUSH");
MODULE_DESCRIPTION("HELLO WORLD");

static int __init hello_init(void)
{
        printk(KERN_INFO"Hello WOrld");
        return 0;

}
static void __exit hello_cleanup(void)
{
        printk(KERN_INFO"Good Bye.\n");

}
module_init(hello_init);
module_exit(hello_cleanup);
```

Makefile

```
obj-m += hello_world.o
KDIR = /lib/modules/$(shell uname -r)/build

all:
        make -C $(KDIR)  M=$(shell pwd) modules
clean:
        make -C $(KDIR)  M=$(shell pwd) clean
```

OUTPUT:


user@user:~/cs20b1057_dd_lab$ ls
hello_world.c hello_world.mod.c Makefile xlinx
hello_world.ko hello_world.mod.o modules.order
hello_world.mod hello_world.o Module.symvers
user@user:~/cs20b1057_dd_lab$ sudo insmod hello_world.ko
user@user:~/cs20b1057_dd_lab$ sudo rmmod hello_world
user@user: ~/cs20b1057_dd_lab
[901.952776] raid6: sse2x1 gen() 14738 MB/s
[902.020776] raid6: sse2x1 xor() 7672 MB/s
[902.020778] raid6: using algorithm avx512x2 gen() 70850 MB/s
[902.020779] raid6: .... xor() 44219 MB/s, rmw enabled
[902.020780] raid6: using avx512x2 recovery algorithm
[902.121685] xor: automatically using best checksumming function avx
[902.204495] Btrfs loaded, crc32c=crc32c-intel, zoned=yes, fsverity=yes
[2527.550197] hello_world: loading out-of-tree module taints kernel.
[2527.550226] hello_world: module verification failed: signature and/or requir
ed key missing - tainting kernel
[2527.551317] Hello WOrld
[2855.421014] Good Bye.
[3196.480141] audit: type=1400 audit(1674033986.913:51): apparmor="ALLOWED" op
eration="open" profile="libreoffice-soffice" name="/usr/share/zoneinfo-icu/44/l
e/zoneinfo64.res" pid=16580 comm="soffice.bin" requested_mask="r" denied_mask="
r" fsuid=1000 ouid=0
[3196.480252] audit: type=1400 audit(1674033986.913:52): apparmor="ALLOWED" op
eration="open" profile="libreoffice-soffice" name="/usr/share/zoneinfo-icu/44/l
e/timezoneTypes.res" pid=16580 comm="soffice.bin" requested_mask="r" denied_mas
[3579.933335] Hello WOrld
[3617.980989] Good Bye.

2)Character Device Driver Porgram (PROGRAM-2)

chr_dev.c (kernel file)

chr_dev.c

```c
#include<linux/kernel.h>
#include<linux/init.h>
#include<linux/module.h>
#include<linux/kdev_t.h>
#include<linux/fs.h>
#include<linux/cdev.h>
#include<linux/device.h>
#include<linux/slab.h>
#include<linux/uaccess.h>

#define mem_size 1024  // Macro for memory size

dev_t dev = 0;
static struct class *dev_class;
static struct cdev my_cdev;

uint8_t *kernel_buffer;

static int __init chr_driver_init(void);
static void __exit chr_driver_exit(void);

static int my_open(struct inode *inode, struct file *file);
static int my_release(struct inode *inode, struct file *file);
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *off);
static ssize_t my_write(struct file *filp, const char *buf, size_t len, loff_t *off);


static struct file_operations fops=
{
        .owner          =       THIS_MODULE,
        .read           =       my_read,
        .write          =       my_write,
        .open           =       my_open,
        .release        =       my_release,
};

static int my_open(struct inode *inode, struct file *file)
{
        // Creating physical Memory
        if((kernel_buffer = kmalloc(mem_size, GFP_KERNEL))==0)
        {
                printk(KERN_INFO"Can NOT allocate the memory to kernel ...\n");
                return -1;
        }
        printk(KERN_INFO "Device File Opened...\n");
        return 0;
}

static int my_release(struct inode *inode, struct file *file)
{
        kfree(kernel_buffer);
        printk(KERN_INFO"Device File Closed...\n");
        return 0;
```

test_chr_dev.c (user file)

test_chr_dev.c

```c
// Compile This File as
//cc test_chr_dev.c -o test_chr_dev.o
//sudo ./test_chr_dev.c


#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include<sys/types.h>
#include<sys/stat.h>
#include<fcntl.h>
#include<unistd.h>

int8_t write_buf[1024];
int8_t read_buf[1024];

int main()
{

        int fd;
        char option;

        printf("Welcome to the Character Device Driver DEMO..\n");
        fd = open("/dev/my_device",O_RDWR);
        if(fd < 0)
        {
                printf("Unable to Open the Device File...\n");
                return 0;
        }

        while(1)
        {
                printf("************** Please Enter Your Options***************\n");
                printf("                        1. Write                                \n");
                printf("                        2. Read                                 \n");
                printf("                        3. Exit                                         \n");
                scanf("%c", &option);
                printf(" Your Options are = %c \n", option);

                switch(option)
                {
                        case '1':
                                printf("Enter the String to Write in to the Driver...\n");
                                scanf(" %[^\t\n]s", write_buf);
                                printf("Data Writtern...\n");
                                write(fd, write_buf, strlen(write_buf)+1);
                                printf("Write Operation Completed ... DONE...\n");
                                break;
                        case '2':
                                printf("Data is Reading....\n");
                                read(fd, read_buf, 1024);
                                printf("Done....\n\n");
                                printf("Data = %s\n\n", read_buf);
```

Make File

```
obj-m += chr_dev.o

KDIR = /lib/modules/$(shell uname -r)/build



all:
        make -C $(KDIR)  M=$(shell pwd) modules

clean:
        make -C $(KDIR)  M=$(shell pwd) clean
```

NOTE : Previously removed chr_dev.ko as it is already been there in the kernel using rmmod

Created a chr_dev.ko file using the Make file given

```
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ ls
chr_dev.c  chr_dev.ko  chr_dev.mod  chr_dev.mod.c  chr_dev.mod.o  chr_dev.o  Makefile  modules.order  Module.symvers  test_chr_dev.c  test_chr_dev.o
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ sudo rmmod chr_dev
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ sudo insmod chr_dev.ko
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ demesg
```

using dmesg to check if driver is successfully added into the kernel

```
[ 4296.783829] audit: type=1400 audit(1674639320.143:63): apparmor="ALLOWED" operation="open" profile="libreoffice-soffice" name="/home/user/EC22B1
" denied_mask="r" fsuid=1000 ouid=1000
[ 4308.136556] kauditd_printk_skb: 7 callbacks suppressed
[ 4308.136563] audit: type=1400 audit(1674639331.495:71): apparmor="ALLOWED" operation="open" profile="libreoffice-soffice" name="/usr/share/zonein
 requested_mask="r" denied_mask="r" fsuid=1000 ouid=0
[ 4308.136659] audit: type=1400 audit(1674639331.495:72): apparmor="ALLOWED" operation="open" profile="libreoffice-soffice" name="/usr/share/zonein
in" requested_mask="r" denied_mask="r" fsuid=1000 ouid=0
[ 5680.835299] Device Driver is Removed Successfully...
[ 5703.571655] Major = 234 and Minor = 0..
[ 5703.571706] Device Driver is inserted properly DONE...
user@user:~/cs20b1057_dd_lab/lab3/character_dd$
```

OUTPUT:

(YELLOW BOX) GIVEN DATA PRTINTED SUCCESSFULLY

```
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ cc test_chr_dev.c -o test_chr_dev.o
user@user:~/cs20b1057_dd_lab/lab3/character_dd$ sudo ./test_chr_dev.o
[sudo] password for user:
Welcome to the Character Device Driver DEMO..
************** Please Enter Your Options***************
                        1. Write
                        2. Read
                        3. Exit
1
 Your Options are = 1
Enter the String to Write in to the Driver...
dhanush
Data Writtern...
Write Operation Completed ... DONE...
************** Please Enter Your Options***************
                        1. Write
                        2. Read
                        3. Exit
 Your Options are =

Enter the Valid Option =

************** Please Enter Your Options***************
                        1. Write
                        2. Read
                        3. Exit
2
 Your Options are = 2
Data is Reading....
Done....

Data = dhanush

************** Please Enter Your Options***************
                        1. Write
                        2. Read
                        3. Exit
 Your Options are =

Enter the Valid Option =

************** Please Enter Your Options***************
                        1. Write
                        2. Read
                        3. Exit
3
 Your Options are = 3
user@user:~/cs20b1057_dd_lab/lab3/character_dd$
```

REMOVING chr_dev.ko from kernel