

## DEVICE DRIVERS LAB 8

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### Wait Queue

### Makefile

Makefile	×	wait.c	×
1 obj-m := wait.o			
2 obj-m := char.o			
3			
4 all:			
5     make -C /lib/modules/\$(shell uname -r)/build M=\$(shell pwd) modules			
6 clean:			
7     make -C /lib/modules/\$(shell uname -r)/build M=\$(shell pwd) clean			

### Using make command

```
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c Instructions_File.pdf Makefile wait.c
user@user:~/cs20b1057_dd_lab/lab8$ make
make -C /lib/modules/5.15.0-67-generic/build M=/home/user/cs20b1057_dd_lab/lab8 modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-67-generic'
  CC [M] /home/user/cs20b1057_dd_lab/lab8/char.o
/home/user/cs20b1057_dd_lab/lab8/char.c: In function 'my_write':
/home/user/cs20b1057_dd_lab/lab8/char.c:65:2: warning: ignoring return value of 'copy_from_user', declared with attribute warn_unused_result [-Wunused-result]
   65 |   copy_from_user(kernel_buffer, buf, len);
      |   ^~~~~~
/home/user/cs20b1057_dd_lab/lab8/char.c: In function 'my_read':
/home/user/cs20b1057_dd_lab/lab8/char.c:58:2: warning: ignoring return value of 'copy_to_user', declared with attribute warn_unused_result [-Wunused-result]
   58 |   copy_to_user(buf, kernel_buffer, mem_size);
      |   ^~~~~~
  MODPOST /home/user/cs20b1057_dd_lab/lab8/Module.symvers
  CC [M] /home/user/cs20b1057_dd_lab/lab8/char.mod.o
  LD [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
  BTF [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
Skipping BTF generation for /home/user/cs20b1057_dd_lab/lab8/char.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-67-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c char.ko char.mod char.mod.c char.mod.o char.o Instructions_File.pdf Makefile modules.order Module.symvers wait.c
user@user:~/cs20b1057_dd_lab/lab8$
```

### Inserting the character device driver module and checking for proper insertion using dmesg command

```
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c char.ko char.mod char.mod.c char.mod.o char.o Instructions_File.pdf Makefile modules.order Module.symvers wait.c
user@user:~/cs20b1057_dd_lab/lab8$ sudo insmod char.ko
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
[ 3405.184987] Device Driver is inserted properly DONE...
```

Using dmesg to check for major and minor number and permissions given to the module

```
user@user:~/cs20b1057_dd_lab/lab8$ ls -l /dev/my_device
crw----- 1 root root 234, 0 Mar 29 14:45 /dev/my_device
user@user:~/cs20b1057_dd_lab/lab8$
```

Removing the module and using dmesg to print

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo rmmod char
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
\[ 1683.566731] Device Driver is Removed Successfully...
user@user:~/cs20b1057_dd_lab/lab8$ \
```

Using make clean to remove the other file extensions

```
user@user:~/cs20b1057_dd_lab/lab8$ make clean
make -C /lib/modules/5.15.0-67-generic/build M=/home/user/cs20b1057_dd_lab/lab8
clean
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-67-generic'
CLEAN /home/user/cs20b1057_dd_lab/lab8/Module.symvers
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-67-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c dd_lab8.odt Instructions_File.pdf Makefile wait.c
user@user:~/cs20b1057_dd_lab/lab8$
```

## 2. Block the reading process of Character Device Blocking the reading process of the char device driver

Before blocking code for reader process

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    copy_to_user(buf, kernel_buffer, mem_size);
    printk(KERN_INFO "Data Read: DONE...\n");
    return mem_size;
}
```

After blocking code for reader process

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside read\n");
    printk(KERN_INFO "Scheduling out\n");
    schedule();
    printk(KERN_INFO "Woken up\n");
    return 0;
}
```

## Using make to get the .ko file

```
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c      char.mod.o      Makefile        wait.ko        wait.o
char.ko     char.o          modules.order   wait.mod
char.mod    dd_lab8.odt     Module.symvers  wait.mod.c
char.mod.c  Instructions_File.pdf  wait.c          wait.mod.o
user@user:~/cs20b1057_dd_lab/lab8$
```

## Inserting the modified module using insmod and printing using dmesg

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo insmod char.ko
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
[ 2195.726844] Device Driver is inserted properly DONE...
user@user:~/cs20b1057_dd_lab/lab8$
```

using sudo cat /dev/mychar0

**NOTE : here my module name is “my\_device”**

**:~ sudo cat dev/my\_device**

```
[ 2477.917271] Device File Opened...
[ 2477.917276] Inside read
[ 2477.917276] Scheduling out
[ 2477.917277] Woken up
[ 2477.917280] Device File Closed...
[ 2479.854070] Device File Opened...
[ 2479.854075] Inside read
[ 2479.854075] Scheduling out
[ 2479.854076] Woken up
[ 2479.854079] Device File Closed...
[ 2487.502283] Device File Opened...
[ 2487.502288] Inside read
[ 2487.502288] Scheduling out
[ 2487.502289] Woken up
[ 2487.502292] Device File Closed...
[ 2488.606090] Device File Opened...
[ 2488.606095] Inside read
[ 2488.606095] Scheduling out
[ 2488.606096] Woken up
[ 2488.606099] Device File Closed...
[ 2489.022177] Device File Opened...
[ 2489.022182] Inside read
[ 2489.022182] Scheduling out
[ 2489.022183] Woken up
[ 2489.022186] Device File Closed...
[ 2540.334282] Device File Opened...
[ 2540.334288] Inside read
[ 2540.334288] Scheduling out
[ 2540.334289] Woken up
[ 2540.334293] Device File Closed...
```

## Removing the modified char module

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo rmmod char
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
\[ 1683.566731] Device Driver is Removed Successfully...
user@user:~/cs20b1057_dd_lab/lab8$ \
```

## Make clean

```
user@user:~/cs20b1057_dd_lab/lab8$ make clean
make -C /lib/modules/5.15.0-67-generic/build M=/home/user/cs20b1057_dd_lab/lab8 clean
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-67-generic'
  CLEAN   /home/user/cs20b1057_dd_lab/lab8/Module.symvers
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-67-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c dd_lab8.odt Instructions_File.pdf Makefile wait.c
user@user:~/cs20b1057_dd_lab/lab8$ \
```

## 3.Block the reading process with interruptible state in the reading process of Character Device

### Modifying the reading process again

Before modifying

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside read\n");
    printk(KERN_INFO "Scheduling out\n");
    schedule();
    printk(KERN_INFO "Woken up\n");
    return 0;
}
```

After modifying

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside read\n");
    printk(KERN_INFO "Scheduling out\n");
    set_current_state(TASK_INTERRUPTIBLE);
    schedule();
    printk(KERN_INFO "Woken up\n");
    return 0;
}
```

### using make again

```
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c      char.mod.o      Makefile        wait.ko        wait.o
char.ko     char.o          modules.order   wait.mod
char.mod    dd_lab8.odt     Module.symvers  wait.mod.c
char.mod.c  Instructions_File.pdf wait.c          wait.mod.o
user@user:~/cs20b1057_dd_lab/lab8$ \
```

## inserting the module using insmod

```
[ 2477.917271] Device File Opened...
[ 2477.917276] Inside read
[ 2477.917276] Scheduling out
[ 2477.917277] Woken up
[ 2477.917280] Device File Closed...
[ 2479.854070] Device File Opened...
[ 2479.854075] Inside read
[ 2479.854075] Scheduling out
[ 2479.854076] Woken up
[ 2479.854079] Device File Closed...
[ 2487.502283] Device File Opened...
[ 2487.502288] Inside read
[ 2487.502288] Scheduling out
[ 2487.502289] Woken up
[ 2487.502292] Device File Closed...
[ 2488.606090] Device File Opened...
[ 2488.606095] Inside read
[ 2488.606095] Scheduling out
[ 2488.606096] Woken up
[ 2488.606099] Device File Closed...
[ 2489.022177] Device File Opened...
[ 2489.022182] Inside read
[ 2489.022182] Scheduling out
[ 2489.022183] Woken up
[ 2489.022186] Device File Closed...
[ 2540.334282] Device File Opened...
[ 2540.334288] Inside read
[ 2540.334288] Scheduling out
[ 2540.334289] Woken up
[ 2540.334293] Device File Closed...
[ 2582.656071] audit: type=1400 audit(1680082618.016:111): appar
pid=16057 comm="oosplash" requested_mask="wr" denied_mask="wr"
[ 2582.656079] audit: type=1400 audit(1680082618.016:112): appar
5" pid=16057 comm="oosplash" requested_mask="r" denied_mask="r"
[ 2582.656082] audit: type=1400 audit(1680082618.016:113): appar
5" pid=16057 comm="oosplash" requested_mask="r" denied_mask="r"
[ 2582.656086] audit: type=1400 audit(1680082618.016:114): appar
5" pid=16057 comm="oosplash" requested_mask="w" denied_mask="w"
[ 2582.656089] audit: type=1400 audit(1680082618.016:115): appar
5" pid=16057 comm="oosplash" requested_mask="w" denied_mask="w"
[ 3031.550423] Device Driver is Removed Successfully...
[ 3049.550891] Major = 234 and Minor = 0..
[ 3049.550962] Device Driver is inserted properly DONE...
[ 3055.646743] Device Driver is Removed Successfully...
[ 3655.711048] Major = 234 and Minor = 0..
[ 3655.711197] Device Driver is inserted properly DONE...
```

**sudo cat dev/my\_device**

Blocked state

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/my_device
```

**Removing the modul in new terminal**

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/my_device

^C
user@user:~/cs20b1057_dd_lab/lab8$ sudo rmmod char
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
[ 3929.774901] Device Driver is Removed Successfully...
user@user:~/cs20b1057_dd_lab/lab8$
```

**make clean**

```
user@user:~/cs20b1057_dd_lab/lab8$ make clean
make -C /lib/modules/5.15.0-67-generic/build M=/home/user/cs20b1057_dd_lab/lab8 clean
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-67-generic'
  CLEAN   /home/user/cs20b1057_dd_lab/lab8/Module.symvers
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-67-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c  dd_lab8.odt  Instructions_File.pdf  Makefile  wait.c
user@user:~/cs20b1057_dd_lab/lab8$
```

**4.Unblocking the Blocked reading process in interruptible state with the writing process of Character Device (without any event)**

**Adding the new declaration sleeping\_task function**

```
//NEW DECLARATION
static struct task_struct *sleeping_task;
```



Before modification

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside read\n");
    printk(KERN_INFO "Scheduling out\n");
    set_current_state(TASK_INTERRUPTIBLE);
    schedule();
    printk(KERN_INFO "Woken up\n");
    return 0;
}

static ssize_t my_write(struct file *filp, const char __user *buf, size_t len, loff_t *loff)
{
    copy_from_user(kernel_buffer, buf, len);
    printk(KERN_INFO "Data is written Successfully...\n");
    return len;
}
```

after modification

```
static ssize_t my_read(struct file *filp, char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside read\n");
    printk(KERN_INFO "Scheduling out\n");
    sleeping_task = current;
    set_current_state(TASK_INTERRUPTIBLE);
    schedule();
    printk(KERN_INFO "Woken up\n");
    return 0;
}

static ssize_t my_write(struct file *filp, const char __user *buf, size_t len, loff_t *loff)
{
    printk(KERN_INFO "Inside write\n");
    wake_up_process(sleeping_task);
    return count;
}
```

## Using make again

```
user@user:~/cs20b1057_dd_lab/lab8$ make
make -C /lib/modules/5.15.0-67-generic/build M=/home/user/cs20b1057_dd_lab/lab8 modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-67-generic'
CC [M] /home/user/cs20b1057_dd_lab/lab8/wait.o
CC [M] /home/user/cs20b1057_dd_lab/lab8/char.o
MODPOST /home/user/cs20b1057_dd_lab/lab8/Module.symvers
CC [M] /home/user/cs20b1057_dd_lab/lab8/char.mod.o
LD [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
BTF [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
Skipping BTF generation for /home/user/cs20b1057_dd_lab/lab8/char.ko due to unavailability of vmlinux
CC [M] /home/user/cs20b1057_dd_lab/lab8/wait.mod.o
LD [M] /home/user/cs20b1057_dd_lab/lab8/wait.ko
BTF [M] /home/user/cs20b1057_dd_lab/lab8/wait.ko
Skipping BTF generation for /home/user/cs20b1057_dd_lab/lab8/wait.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-67-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c char.ko char.mod char.mod.c char.mod.o char.o dd_lab8.odt Instructions_File.pdf Makefile modules.order Module.symvers wait.c wait.ko
user@user:~/cs20b1057_dd_lab/lab8$
```

## Inserting the module using insmod and using dmesg to print

```
[ 4716.775819] Major = 234 and Minor = 0..  
[ 4716.775997] Device Driver is inserted properly DONE..  
user@user:~/cs20b1057_dd_lab/lab8$
```

`sudo cat dev/my_device`

Blocked state

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/my_device
```

## Opening the new terminal and entering dmesg

(In old terminal the reading process is blocked and after entering

**`sudo bash -c "echo 1 > /dev/mychar110"`** in new terminal it is unblocked  
and with dmesg we can see the flow of wakeup process

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo insmod wait  
insmod: ERROR: could not load module wait: No such file or directory  
user@user:~/cs20b1057_dd_lab/lab8$ sudo insmod wait.ko  
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/mychar110  
  
user@user:~/cs20b1057_dd_lab/lab8$  
user@user:~/cs20b1057_dd_lab/lab8$
```

```
user@user: ~  
[ 506.597498] Inside Write  
[ 506.597499] Inside Write  
[ 506.597499] Inside Write  
[ 506.597500] Inside Write  
[ 506.597500] Inside Write  
[ 506.597500] Inside Write  
[ 506.597501] Inside Write  
[ 506.597501] Inside Write  
[ 506.597501] Inside Write  
[ 506.597502] Inside Write  
[ 506.597502] Inside Write  
[ 506.597503] Inside Write  
[ 506.597503] Inside Write  
[ 506.597504] Inside Write  
[ 506.597504] Inside Write  
[ 506.597615] Inside close  
[ 598.799368] Inside cleanup_module  
[ 610.414694] Major Nr: 234  
[ 626.222853] Inside open  
[ 626.222858] Inside read  
[ 626.222858] Scheduling out  
user@user:~$ sudo bash -c "echo 1 > /dev/mychar110"  
user@user:~$
```



using dmesg to see the flow of wake up process

```
[ 506.597501] Inside Write
[ 506.597501] Inside Write
[ 506.597502] Inside Write
[ 506.597502] Inside Write
[ 506.597503] Inside Write
[ 506.597503] Inside Write
[ 506.597503] Inside Write
[ 506.597504] Inside Write
[ 506.597504] Inside Write
[ 506.597615] Inside close
[ 598.799368] Inside cleanup_module
[ 610.414694] Major Nr: 234
[ 626.222853] Inside open
[ 626.222858] Inside read
[ 626.222858] Scheduling out
[ 652.191401] Inside open
[ 652.191407] Inside write
[ 652.191409] Inside close
[ 652.191444] Woken up
[ 652.191461] Inside close
user@user:~$
```

Removing the module and using dmesg to print and using make clean

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo rmmod wait
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
[ 942.287274] Inside cleanup_module
user@user:~/cs20b1057_dd_lab/lab8$
```

#### 4. Unblocking the Blocked reading process in interruptible state with the writing process of Character Device (with event)

Adding new declarations

```
2 //NEW DECLARATIONS
3 static char flag = 'n';
4 static dev_t dev;
5 static struct cdev c_dev;
5 static struct class *cl;
7 static DECLARE_WAIT_QUEUE_HEAD(wq);
8
```

## Modified read and write processes

```
-
2 ssize_t read(struct file *filp, char *buff, size_t count, loff_t *offp)
3 {
4     printk(KERN_INFO "Inside read\n");
5     printk(KERN_INFO "Scheduling out\n");
6     wait_event_interruptible(wq, flag='y');
7     //wait_event_timeout(queue, condition, timeout);
8     flag = 'n'
9     printk(KERN_INFO "Woken up\n");
10    return 0;
11 }
12
13 ssize_t write(struct file *filp, const char *buff, size_t count, loff_t *offp)
14 {
15     printk(KERN_INFO "Inside write\n");
16     if(copy_from_user(&flag, buff, 1))
17     {
18         return -EFAULT;
19     }
20     printk(KERN_INFO "%c", flag);
21     wake_up_interruptible(&wq);
22     return count;
23 }
```

## Using make

```
user@user:~/cs20b1057_dd_lab/lab8$ make
make -C /lib/modules/5.15.0-69-generic/build M=/home/user/cs20b1057_dd_lab/lab8 modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-69-generic'
CC [M] /home/user/cs20b1057_dd_lab/lab8/wait.o
In file included from ./include/linux/swait.h:8,
                 from ./include/linux/completion.h:12,
                 from ./include/linux/mm_types.h:12,
                 from ./include/linux/buildid.h:5,
                 from ./include/linux/module.h:14,
                 from /home/user/cs20b1057_dd_lab/lab8/wait.c:1:
/home/user/cs20b1057_dd_lab/lab8/wait.c: In function 'read':
/home/user/cs20b1057_dd_lab/lab8/wait.c:46:30: warning: suggest parentheses around assignment used as truth value [-Wparentheses]
  46 |     wait_event_interruptible(wq, flag='y');
      |                               ^
./include/linux/wait.h:310:7: note: in definition of macro '___wait_event'
 310 |     if (condition) \
      |         ^
./include/linux/wait.h:501:11: note: in expansion of macro '___wait_event_interruptible'
 501 |     __ret = ___wait_event_interruptible(wq_head, condition); \
      |           ^
/home/user/cs20b1057_dd_lab/lab8/wait.c:46:2: note: in expansion of macro 'wait_event_interruptible'
  46 |     wait_event_interruptible(wq, flag='y');
      |     ^
At top level:
/home/user/cs20b1057_dd_lab/lab8/wait.c:20:28: warning: 'sleeping_task' defined but not used [-Wunused-variable]
  20 | static struct task_struct *sleeping_task;
      |
CC [M] /home/user/cs20b1057_dd_lab/lab8/char.o
MODPOST /home/user/cs20b1057_dd_lab/lab8/Module.symvers
CC [M] /home/user/cs20b1057_dd_lab/lab8/char.mod.o
LD [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
BTF [M] /home/user/cs20b1057_dd_lab/lab8/char.ko
Skipping BTF generation for /home/user/cs20b1057_dd_lab/lab8/char.ko due to unavailability of vmlinux
CC [M] /home/user/cs20b1057_dd_lab/lab8/wait.mod.o
LD [M] /home/user/cs20b1057_dd_lab/lab8/wait.ko
BTF [M] /home/user/cs20b1057_dd_lab/lab8/wait.ko
Skipping BTF generation for /home/user/cs20b1057_dd_lab/lab8/wait.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-69-generic'
user@user:~/cs20b1057_dd_lab/lab8$ ls
char.c      char.mod.o      Makefile        wait.ko        wait.o
char.ko     char.o          modules.order   wait.mod
char.mod    dd_lab8.odt     Module.symvers  wait.mod.c
char.mod.c  Instructions_File.pdf  wait.c          wait.mod.o
```

## Inserting the module using insmod and printing using dmesg

```
user@user:~/cs20b1057_dd_lab/lab8$ dmesg|tail -1
[ 1451.199742] Major Nr: 234
user@user:~/cs20b1057_dd_lab/lab8$
```

## Using sudo cat dev/mychar110

Blocked state

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/mychar110
```

## Using dmesg to check the state

```
1451.199742] Major Nr: 234
1515.326976] Inside open
1515.326981] Inside read
1515.326981] Scheduling out
1515.326982] Woken up
1515.326984] Inside close
1615.375439] Inside cleanup_module
1621.998780] Major Nr: 234
1626.559137] Inside open
1626.559142] Inside read
1626.559142] Scheduling out
```

in new terminal using command : `sudo bash -c "echo 'y' > /dev/mychar110"` to invoke write and to wakeup the process

```
user@user:~/cs20b1057_dd_lab/lab8$ sudo rmmod wait
user@user:~/cs20b1057_dd_lab/lab8$ sudo insmod wait.ko
user@user:~/cs20b1057_dd_lab/lab8$ sudo cat /dev/mychar110
```

```
user@user:~/cs20b1057_dd_lab/lab8$
user@user:~/cs20b1057_dd_lab/lab8$
```

```
1515.326976] Inside open
```

```
user@user: ~
user@user:~$ sudo bash -c "echo 1 > /dev/mychar110"
[sudo] password for user:
user@user:~$ sudo bash -c "echo 'y' > /dev/mychar110"
user@user:~$
```

## removing the module

```
user@user:~$ dmesg|tail -1  
[ 1937.215255]  Inside cleanup_module  
user@user:~$
```

## make clean

```
user@user:~/cs20b1057_dd_lab/lab8$ make clean  
make -C /lib/modules/5.15.0-69-generic/build M=/home/user/cs20b1057_dd_lab/lab8  
clean  
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-69-generic'  
  CLEAN   /home/user/cs20b1057_dd_lab/lab8/Module.symvers  
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-69-generic'  
user@user:~/cs20b1057_dd_lab/lab8$ ls  
char.c  dd_lab8.odt  Instructions_File.pdf  Makefile  wait.c
```