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با توجه به اینکه در تمرین ۲ باید از اطلاعات تمرین ۱ هم استفاده کرد پس گزارش تمرین ۲ را به ازای هردو تمرین تحویل میدهیم .

۱ - ابتدا فایل c و Makefile را همانند دستور کار میسازیم .

```
Edit Selection View Go Run Terminal Help
OSLab2-part2.c Makefile x
home > mmnazari > Desktop > OSLab2 > Makefile
1  obj-m += OSLab2-part2.o
2  all:
3      make -C /lib/modules/$(shell uname -r)/build M=$(PWD) modul
4  clean:
5      make -C /lib/modules/$(shell uname -r)/build M=$(PWD) clean
```

```
Edit Selection View Go Run Terminal Help
OSLab2-part2.c x Makefile
home > mmnazari > Desktop > OSLab2 > OSLab2-part2.c
1  #include <linux/init.h>
2  #include <linux/module.h>
3  #include <linux/kernel.h>
4  #include <linux/list.h>
5  #include <linux/slab.h>
6  #include <linux/types.h>
7
8  struct birthday {
9      int day ;
10     int month ;
11     int year ;
12     struct list_head list ;
13 };
14
15 static LIST_HEAD(birthday_list) ;
16 struct birthday *person01 = NULL ;
17 struct birthday *person02 = NULL ;
18 struct birthday *person03 = NULL ;
19 struct birthday *person04 = NULL ;
20 struct birthday *person05 = NULL ;
21
22 int simple_init(void){
23     printk(KERN_INFO "Loading Module\n") ;
24     INIT_LIST_HEAD(&birthday_list) ;
25 }
```

```
Edit | Selection | View | Go | Run | Terminal | Help
C OSLab2-part2.c x M Makefile
home > mmnazari > Desktop > OSLab2 > C OSLab2-part2.c

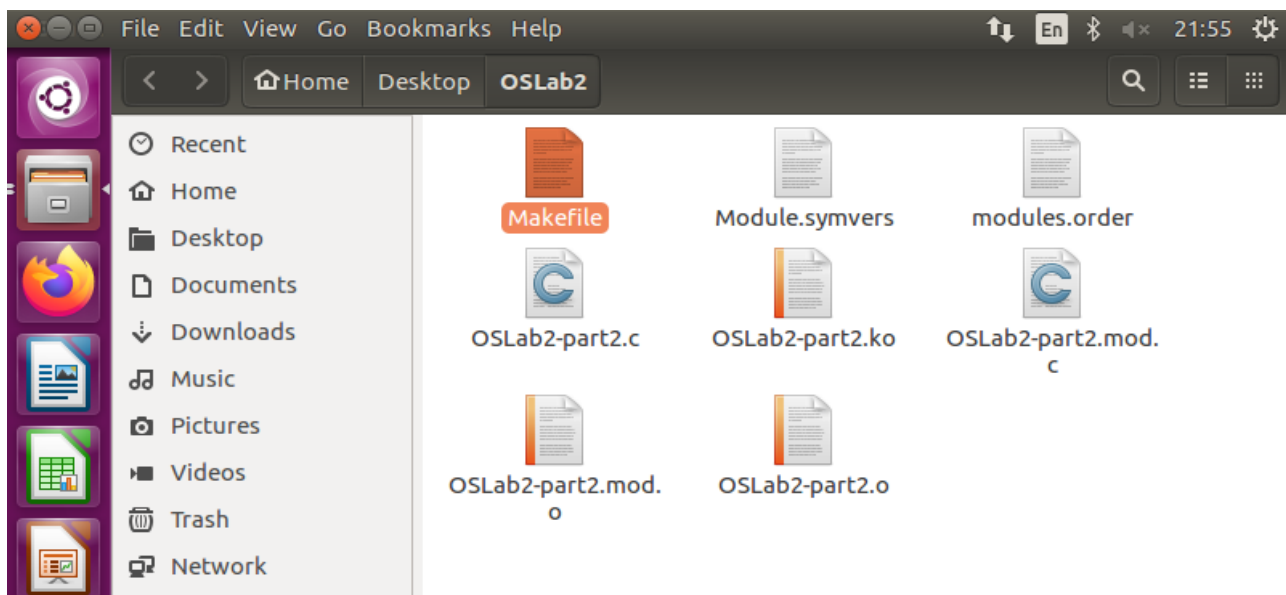
26     person01 = kmalloc(sizeof(person01), GFP_KERNEL) ;
27     person01 -> day = 01 ;
28     person01 -> month = 01 ;
29     person01 -> year = 2001 ;
30     list_add_tail(&person01 -> list, &birthday_list) ;
31
32     person02 = kmalloc(sizeof(person02), GFP_KERNEL) ;
33     person02 -> day = 02 ;
34     person02 -> month = 02 ;
35     person02 -> year = 2002 ;
36     list_add_tail(&person02 -> list, &birthday_list) ;
37
38     person03 = kmalloc(sizeof(person03), GFP_KERNEL) ;
39     person03 -> day = 03 ;
40     person03 -> month = 03 ;
41     person03 -> year = 2003 ;
42     list_add_tail(&person03 -> list, &birthday_list) ;
43
44     person04 = kmalloc(sizeof(person04), GFP_KERNEL) ;
45     person04 -> day = 04 ;
46     person04 -> month = 04 ;
47     person04 -> year = 2004 ;
48     list_add_tail(&person04 -> list, &birthday_list) ;
49
50     person05 = kmalloc(sizeof(person05), GFP_KERNEL) ;
51     person05 -> day = 05 ;
```

```
Edit | Selection | View | Go | Run | Terminal | Help
C OSLab2-part2.c x M Makefile
home > mmnazari > Desktop > OSLab2 > C OSLab2-part2.c

52     person05 -> month = 05 ;
53     person05 -> year = 2005 ;
54     list_add_tail(&person05 -> list, &birthday_list) ;
55
56     struct birthday *ptr ;
57     list_for_each_entry(ptr, &birthday_list, list){
58         printk(KERN_INFO "Date : %d-%d-%d\n", ptr -> day, ptr -> month, ptr -> year) ;
59     }
60     return 0 ;
61 }
62
63 void simple_exit(void){
64     struct birthday *ptr1,*next;
65     list_for_each_entry_safe(ptr1, next, &birthday_list, list)
66     {
67         list_del(&ptr1 -> list) ;
68         kfree(ptr1) ;
69     }
70     printk(KERN_INFO "Removing Module\n") ;
71 }
72
73 module_init(simple_init) ;
74 module_exit(simple_exit) ;
75 MODULE_LICENSE("GPL") ;
76 MODULE_DESCRIPTION("simple module") ;
77 MODULE_AUTHOR("SGG") ;
```

۲ - سپس با دستور make فایل های c را کامپایل میکنیم و یک فایل ko. با همان اسم برای ما ساخته میشود.

```
Terminal File Edit View Search Terminal Help
mmnazari@MMNazari1380:~$ cd Desktop/
mmnazari@MMNazari1380:~/Desktop$ cd OSLab2/
mmnazari@MMNazari1380:~/Desktop/OSLab2$ make
Makefile:3: *** missing separator. Stop.
mmnazari@MMNazari1380:~/Desktop/OSLab2$ cat -e -t -v Makefile
obj-m += OSLab2-part2.o$
all:$
make -C /lib/modules/$(shell uname -r)/build M=$(PWD) modules$
clean:$
make -C /lib/modules/$(shell uname -r)/build M=$(PWD) cleanmmnazari@MMNazari1380
:~/Desktop/OSLab2$ make
make -C /lib/modules/4.15.0-142-generic/build M=/home/mmnazari/Desktop/OSLab2 mo
dules
make[1]: Entering directory '/usr/src/linux-headers-4.15.0-142-generic'
CC [M] /home/mmnazari/Desktop/OSLab2/OSLab2-part2.o
/home/mmnazari/Desktop/OSLab2/OSLab2-part2.c: In function 'simple_init':
/home/mmnazari/Desktop/OSLab2/OSLab2-part2.c:56:5: warning: ISO C90 forbids mixe
d declarations and code [-Wdeclaration-after-statement]
    struct birthday *ptr ;
    ^
Building modules, stage 2.
MODPOST 1 modules
CC /home/mmnazari/Desktop/OSLab2/OSLab2-part2.mod.o
LD [M] /home/mmnazari/Desktop/OSLab2/OSLab2-part2.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-142-generic'
mmnazari@MMNazari1380:~/Desktop/OSLab2$ sudo insmod OSLab2-part2.ko
[sudo] password for mmnazari:
mmnazari@MMNazari1380:~/Desktop/OSLab2$ dmesg
[ 0.000000] Linux version 4.15.0-142-generic (buildd@lgw01-amd64-039) (gcc ve
rsion 5.4.0 20160609 (Ubuntu 5.4.0-6ubuntu1~16.04.12)) #146~16.04.1-Ubuntu SMP T
ue Apr 13 09:27:15 UTC 2021 (Ubuntu 4.15.0-142.146~16.04.1-generic 4.15.18)
[ 0.000000] Command line: BOOT_IMAGE=/boot/vmlinuz-4.15.0-142-generic root=UU
ID=f2fe546f-f950-497d-ba11-f0c30eecdf08 ro quiet splash
```



۳ - سپس با insmod ماژول را بارگذاری کرده و با دستور dmesg وضعیت بافر و ماژول هارا بررسی میکنیم (عکس دستور در قسمت قبل قرار دارد).

```
mmnazari@MMNazari1380: ~/Desktop/OSLab2
[ 25.542014] Adding 998396k swap on /dev/sda5. Priority:-2 extents:1 across:998396k FS
[ 32.268726] Bluetooth: BNEP (Ethernet Emulation) ver 1.3
[ 32.268739] Bluetooth: BNEP filters: protocol multicast
[ 32.268751] Bluetooth: BNEP socket layer initialized
[ 37.245462] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 37.247467] pcnet32 0000:02:01.0 ens33: link up
[ 57.122032] Bluetooth: RFCOMM TTY layer initialized
[ 57.122046] Bluetooth: RFCOMM socket layer initialized
[ 57.122068] Bluetooth: RFCOMM ver 1.11
[ 358.726077] ISO 9660 Extensions: Microsoft Joliet Level 3
[ 358.914864] ISO 9660 Extensions: RRIP_1991A
[ 478.121875] OSLab2_part2: loading out-of-tree module taints kernel.
[ 478.122026] OSLab2_part2: module verification failed: signature and/or required key missing - tainting kernel
[ 478.132185] Loading Module
[ 478.132195] Date : 1-1-2001
[ 478.132197] Date : 2-2-2002
[ 478.132200] Date : 3-3-2003
[ 478.132202] Date : 4-4-2004
[ 478.132204] Date : 5-5-2005
mmnazari@MMNazari1380:~/Desktop/OSLab2$
```

۴ - در آخر هم با rmmod ماژول را برداشته و با دستور dmesg -c برداشته شدن ماژول از بافر را چک میکنیم .

```
mmnazari@MMNazari1380: ~/Desktop/OSLab2
[ 607.047113] Date : 3-3-2003
[ 607.047114] Date : 4-4-2004
[ 607.047115] Date : 5-5-2005
mmnazari@MMNazari1380:~/Desktop/OSLab2$ sudo rmmod OSLab2-part2
mmnazari@MMNazari1380:~/Desktop/OSLab2$ sudo dmesg -c
[ 0.000000] Linux version 4.15.0-142-generic (buildd@lgw01-amd64-039) (gcc version 5.4.0 20160609 (Ubuntu 5.4.0-6ubuntu1~16.04.12)) #146~16.04.1-Ubuntu SMP Tue Apr 13 09:27:15 UTC 2021 (Ubuntu 4.15.0-142.146~16.04.1-generic 4.15.18)
[ 0.000000] Command line: BOOT_IMAGE=/boot/vmlinuz-4.15.0-142-generic root=UUID=f2fe546f-f950-497d-ba11-f0c30eecdff08 ro quiet splash
[ 0.000000] KERNEL supported cpus:
[ 0.000000] Intel GenuineIntel
[ 0.000000] AMD AuthenticAMD
[ 0.000000] Centaur CentaurHauls
[ 0.000000] Disabled fast string operations
[ 0.000000] x86/fpu: Supporting XSAVE feature 0x001: 'x87 floating point registers'
[ 0.000000] x86/fpu: Supporting XSAVE feature 0x002: 'SSE registers'
[ 0.000000] x86/fpu: Supporting XSAVE feature 0x004: 'AVX registers'
[ 0.000000] x86/fpu: xstate_offset[2]: 576, xstate_sizes[2]: 256
[ 0.000000] x86/fpu: Enabled xstate features 0x7, context size is 832 bytes, using 'standard' format.
[ 0.000000] e820: BIOS-provided physical RAM map:
[ 0.000000] BIOS-e820: [mem 0x0000000000000000-0x00000000000009e7ff] usable
```

```
Terminal
mmnazari@MMNazari1380: ~/Desktop/OSLab2
[ 97.695977] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 97.699664] pcnet32 0000:02:01.0 ens33: link up
[114.094211] hrtimer: interrupt took 13058783 ns
[138.023951] sched: RT throttling activated
[140.625858] Bluetooth: RFCOMM TTY layer initialized
[140.625874] Bluetooth: RFCOMM socket layer initialized
[140.625894] Bluetooth: RFCOMM ver 1.11
[254.826410] tsc: Refined TSC clocksource calibration: 2394.462 MHz
[254.826561] clocksource: tsc: mask: 0xffffffffffffffff max_cycles: 0x2283c7bd
99f, max_idle_ns: 440795233967 ns
[254.826725] clocksource: Switched to clocksource tsc
[338.342685] ISO 9660 Extensions: Microsoft Joliet Level 3
[338.457065] ISO 9660 Extensions: RRIP_1991A
[607.044512] OSLab2_part2: loading out-of-tree module taints kernel.
[607.044683] OSLab2_part2: module verification failed: signature and/or require
ed key missing - tainting kernel
[607.047105] Loading Module
[607.047110] Date : 1-1-2001
[607.047111] Date : 2-2-2002
[607.047113] Date : 3-3-2003
[607.047114] Date : 4-4-2004
[607.047115] Date : 5-5-2005
[650.627934] Removing Module
mmnazari@MMNazari1380:~/Desktop/OSLab2$
```