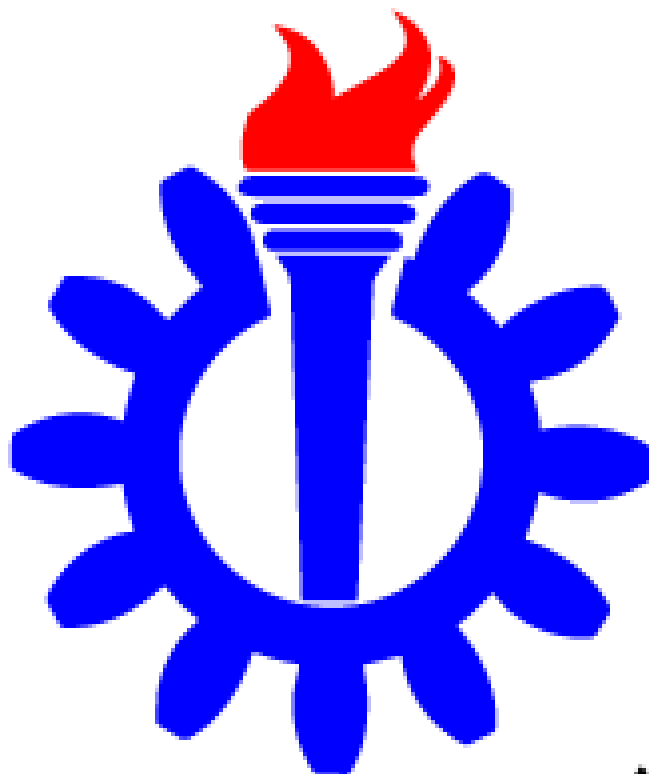بسم الله الرحمن رحیم

دانشگاه علم و صنعت ایران

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تمرین یازدهم کلاس آز سیستم عامل

```
erfanzare-98411432@ubuntu:~$ lsmod
Module                  Size  Used by
rfcomm                  77824  0
bnep                    20480  2
snd_ens1371             28672  2
snd_ac97_codec         131072  1 snd_ens1371
gameport                16384  1 snd_ens1371
ac97_bus                16384  1 snd_ac97_codec
snd_pcm                 98304  2 snd_ac97_codec,snd_ens1371
snd_seq_midi            16384  0
crct10dif_pclmul        16384  0
crc32_pclmul            16384  0
snd_seq_midi_event      16384  1 snd_seq_midi
ghash_clmulni_intel     16384  0
pcbc                    16384  0
snd_rawmidi             32768  2 snd_seq_midi,snd_ens1371
btusb                   45056  0
btrtl                   16384  1 btusb
snd_seq                 65536  2 snd_seq_midi,snd_seq_midi_event
aesni_intel            188416  0
btbcm                   16384  1 btusb
snd_seq_device          16384  3 snd_seq,snd_seq_midi,snd_rawmidi
btintel                 16384  1 btusb
snd_timer               32768  2 snd_seq,snd_pcm
bluetooth              524288  31 btrtl,btintel,btbcm,bnep,btusb,rfcomm
vmw_balloon             20480  0
```

```
codec,snd_pcm,snd_rawmidi,snd_ens1371
joydev                  24576  0
aes_x86_64              20480  1 aesni_intel
crypto_simd             16384  1 aesni_intel
glue_helper             16384  1 aesni_intel
input_leds              16384  0
cryptd                  24576  3 crypto_simd,ghash_clmulni_intel,aesni_intel
serio_raw               16384  0
soundcore               16384  1 snd
ecdh_generic            24576  1 bluetooth
shpchp                  36864  0
mac_hid                 16384  0
i2c_piix4               24576  0
vmw_vsock_vmci_transport  32768  2
vsock                   36864  3 vmw_vsock_vmci_transport
vmw_vmci                69632  2 vmw_balloon,vmw_vsock_vmci_transport
parport_pc              32768  0
ppdev                   20480  0
lp                      20480  0
parport                 49152  3 parport_pc,lp,ppdev
autofs4                 40960  2
hid_generic             16384  0
usbhid                  49152  0
hid                    122880  2 usbhid,hid_generic
vmwgfx                 278528  4
mptspi                  24576  2
```

```
drm_kms_helper         172032   1 vmwgfx
syscopyarea             16384   1 drm_kms_helper
mptbase                102400   2 mptspi,mptscsih
sysfillrect             16384   1 drm_kms_helper
sysimgblt               16384   1 drm_kms_helper
ahci                    40960   0
fb_sys_fops             16384   1 drm_kms_helper
e1000                  143360   0
libahci                 32768   1 ahci
drm                    401408   7 vmwgfx,drm_kms_helper,ttm
scsi_transport_spi      32768   1 mptspi
pata_acpi               16384   0
```

```c
#include<linux/init.h>
#include<linux/kernel.h>
#include<linux/module.h>

int simple_init(void)
{
        printk(KERN_INFO "Loading Module\n");
        return 0;
}
void simple_exit(void)
{
        printk(KERN_INFO "Removing Module\n");
}
module_init(simple_init);
module_exit(simple_exit);
MODULE_LICENSE("GPL");
MODULE_DESCRIPTION("simple module");
MODULE_AUTHOR("SGG");
```

```
erfanzare-98411432@ubuntu:/lib/modules$ sudo make
make -C /lib/modules/4.15.0-142-generic/build M=/lib/modules modules
make[1]: Entering directory '/usr/src/linux-headers-4.15.0-142-generic'
  CC [M]  /lib/modules/simple.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /lib/modules/simple.mod.o
  LD [M]  /lib/modules/simple.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-142-generic'
erfanzare-98411432@ubuntu:/lib/modules$ ls
4.15.0-112-generic  4.15.0-142-generic  Makefile  modules.order  Module.symvers  simple.c  simple.ko  simple.mod.c  simple.mod.o  simple.o  t11q1.c
```

```
erfanzare-98411432@ubuntu:/lib/modules$ sudo insmod simple.ko
```

```
erfanzare-98411432@ubuntu:/lib/modules$ dmesg
```

```
[ 5121.489979] R13: 000000000001a6a0 R14: 0000000000000000 R15: ffffffff88caa580
[ 5121.489979] FS:  00007fb7f7a4a780(0000) GS:ffff90f218680000(0000) knlGS:0000000000000000
[ 5121.489979] CS:  0010 DS: 0000 ES: 0000 CR0: 0000000080050033
[ 5121.489979] CR2: 0000562a5ef5b220 CR3: 000000008fcfa004 CR4: 00000000003606e0
[ 5121.489979] Call Trace:
[ 5121.489980]  <IRQ>
[ 5121.489980]  _raw_spin_lock_irqsave+0x37/0x40
[ 5121.489980]  rcu_check_callbacks+0x52d/0x930
[ 5121.489980]  ? tick_sched_do_timer+0x50/0x50
[ 5121.489980]  update_process_times+0x2f/0x60
[ 5121.489980]  tick_sched_handle+0x2a/0x60
[ 5121.489981]  tick_sched_timer+0x39/0x80
[ 5121.489981]  __hrtimer_run_queues+0xe7/0x230
[ 5121.489981]  hrtimer_interrupt+0xb1/0x200
[ 5121.489981]  smp_apic_timer_interrupt+0x6f/0x150
[ 5121.489981]  apic_timer_interrupt+0x90/0xa0
[ 5121.489981] RIP: 0010:__do_softirq+0x70/0x2a8
[ 5121.489982] RSP: 0000:ffff90f218683f68 EFLAGS: 00000286 ORIG_RAX: ffffffffffffff11
[ 5121.489982] RAX: ffff90f20fcc1700 RBX: 0000000000000002 RCX: 00000000000006e0
[ 5121.489982] RDX: ffff90f217600002 RSI: 00000000d0409ae7 RDI: 00000000000006e0
[ 5121.489982] RBP: ffff90f218683fb8 R08: 000003c861f83900 R09: ffff90f2186a1938
[ 5121.489983] R10: 000000000000080d R11: 0000000000000001 R12: 0000000000000000
[ 5121.489983] R13: 0000000000000000 R14: 0000000000000000 R15: 0000000000000000
[ 5121.489983]  irq_exit+0xca/0xd0
[ 5121.489983]  smp_apic_timer_interrupt+0x79/0x150
[ 5121.489983]  apic_timer_interrupt+0x90/0xa0
[ 5121.489983]  </IRQ>
[ 5121.489984] RIP: 0033:0x7fb7f6e88e50
[ 5121.489984] RSP: 002b:00007ffe51327d68 EFLAGS: 00000202 ORIG_RAX: ffffffffffffff11
[ 5121.490007] RAX: 0000000001418f00 RBX: 0000000000141cee0 RCX: 0000000000000000
[ 5121.490007] RDX: 0000000000000001 RSI: 0000000000000001 RDI: 000000000141cee0
[ 5121.490007] RBP: 0000000000000001 R08: 0000000000000010 R09: 0000000000000004
[ 5121.490008] R10: 00000000014daf20 R11: 0000000000000000 R12: 000000000141cee0
[ 5121.490008] R13: 0000000000000000 R14: 00007fb7f6e9b3f0 R15: 000000000000000c
[ 5121.490008] Code: ff ff 0f 1f 40 00 0f 1f 44 00 00 55 48 89 e5 0f 1f 44 00 00 ba 01 00 00 00 8b 07 85 c0 75 0a f0 0f b1 17 85 c0 75 f2 5d c3 f3 90 <
1c 01 00 00 40 80 e6 00 85 f6 75
[ 5121.490067] NMI backtrace for cpu 3
[ 5121.490070] CPU: 3 PID: 1928 Comm: compiz Tainted: G         W    L    4.15.0-142-generic #146~16.04.1-Ubuntu
[ 5121.490071] Hardware name: VMware, Inc. VMware Virtual Platform/440BX Desktop Reference Platform, BIOS 6.00 11/12/2020
[ 5121.490096] Call Trace:
[ 5121.490098]  <IRQ>
[ 5121.490103]  dump_stack+0x6d/0x8b
[ 5121.490104]  nmi_cpu_backtrace+0x95/0xa0
[ 5121.490108]  ? lapic_can_unplug_cpu+0xb0/0xb0
[ 5121.490109]  nmi_trigger_cpumask_backtrace+0xf0/0x140
[ 5121.490111]  arch_trigger_cpumask_backtrace+0x19/0x20
[ 5121.490112]  rcu_dump_cpu_stacks+0x9a/0xce
[ 5121.490114]  rcu_check_callbacks+0x7e4/0x930
[ 5121.490116]  ? tick_sched_do_timer+0x50/0x50
[ 5121.490117]  update_process_times+0x2f/0x60
```

```
rfanzare-98411432@ubuntu:/lib/modules$ sudo rmmod simple
             : Module simple is not currently loaded
```

```
erfanzare-98411432@ubuntu:/lib/modules$ sudo dmesg -c
```

```
[ 5148.178219] RDX: 0000000000002000 RSI: 00007fff8ec0dc20 RDI: 0000000000000007
[ 5148.178220] RBP: 0000000002603360 R08: 0000000002601920 R09: 0000000000000000
[ 5148.178220] R10: 00007fff8ec0fcf0 R11: 0000000000000293 R12: 000000000381dc20
[ 5148.178221] R13: 00007fff8ec0dc20 R14: 00000000025c6d70 R15: 00000000026009d0
[ 5148.178221] Code: da 89 5d d4 65 81 05 3c 5b c1 77 00 01 00 00 c7 45 c8 0a 00 00 00 48 89 45 b8 65 66 c7 05 57 10 c2
t0 88 0f bc 45 d4 83 c0 01 89 45
[ 5155.036009] e1000: ens33 NIC Link is Down
[ 5155.036265] e1000 0000:02:01.0 ens33: Reset adapter
[ 5155.060776] mptscsih: ioc0: attempting target reset! (sc=000000002c73e965)
[ 5155.060789] sd 2:0:0:0: [sda] tag#0 CDB: Write(10) 2a 00 01 05 3b f8 00 00 18 00
[ 5155.251341] mptscsih: ioc0: target reset: SUCCESS (sc=000000002c73e965)
[ 5155.325207] scsi target2:0:0: Beginning Domain Validation
[ 5155.347099] scsi target2:0:0: Domain Validation skipping write tests
[ 5155.347102] scsi target2:0:0: Ending Domain Validation
[ 5155.347733] scsi target2:0:0: FAST-40 WIDE SCSI 80.0 MB/s ST (25 ns, offset 127)
[ 5161.177718] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 5644.345500] usb 2-2.1: USB disconnect, device number 5
[ 5644.628229] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 5644.632427] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 5644.638456] usb 2-2.1: new full-speed USB device number 6 using uhci_hcd
[ 5644.639411] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 5644.641330] IPv6: ADDRCONF(NETDEV_CHANGE): ens33: link becomes ready
[ 5644.766291] usb 2-2.1: New USB device found, idVendor=0e0f, idProduct=0008
[ 5644.768293] usb 2-2.1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 5644.768294] usb 2-2.1: Product: Virtual Bluetooth Adapter
[ 5644.768295] usb 2-2.1: Manufacturer: VMware
[ 5644.768295] usb 2-2.1: SerialNumber: 000650268328
[ 6459.351892] e1000: ens33 NIC Link is Down
[ 6465.393757] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 6473.461723] e1000: ens33 NIC Link is Down
[ 6473.461723] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 6477.494945] e1000: ens33 NIC Link is Down
[ 6483.546538] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 6634.542629] simple: loading out-of-tree module taints kernel.
```

```c
#include <linux/init.h>
#include <linux/module.h>
#include <linux/kernel.h>
#include <linux/slab.h>
#include <linux/list.h>
#include <liux/types.h>

struct birthday{
        int day;
        int month;
        int year;
        struct list_head list;
};
static LIST_HEAD(birthday_list);

int simple_init(void) {
        struct birthday *person;
        int i;
        printk(KERN_INFO "Loading Module\n");
        for(i=0;i<5 ; i++){
            person=lmalloc(sizeof(*person),GFP_KERNEL);
            person -> day = i+2;
            person -> month =i+3;
            person -> year = i+1999;
            INIT_LIST_HEAD(&person -> list);
            list_add_tail(&person -> list, &birthday_list);
        }
        list_for_each_entry(person, &birthday_list, list) {
            printk(KERN_INFO "Birthday: %d/%d/ %d \n",person -> month, person -> da$);
        }
        return 0;
}

void simple_exit(void)
{
        struct birthday *ptr, next;
        printk(KERN_INFO "Removing Module\n");
        list_for_each_entry_safe(ptr ,next,&birthday_list, list){
            printk(KERN_INFO "Removing %d %d %d\n",ptr->month,ptr->day,ptr->year);
            list_del(&ptr -> list);
            kfree(ptr);
        }
}

module_init( simple_init );
```

```
erfanzare-98411432@ubuntu:/lib/modules$ sudo make
make -C /lib/modules/4.15.0-142-generic/build M=/lib/modules modules
make[1]: Entering directory '/usr/src/linux-headers-4.15.0-142-generic'
  Building modules, stage 2.
  MODPOST 1 modules
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-142-generic'
```

```
5714.709333] Loading Module
5714.709335] Birthday: 3/2/ 1999
5714.709335] Birthday: 4/3/ 2000
5714.709336] Birthday: 5/4/ 2001
5714.709336] Birthday: 6/5/ 2002
5714.709336] Birthday: 7/6/ 2003
```