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Кафедра обчислювальної техніки ФІОТ**

**ЗВІТ  
з лабораторної роботи №5  
з навчальної дисципліни  
«Архітектура комп'ютерів-2. Процесори»**

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## Hello.c

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

MODULE_AUTHOR("Maksym Manchuk IB-93");
MODULE_DESCRIPTION("Computer Architecture Lab5");
MODULE_LICENSE("Dual BSD/GPL");

static int amount = 1;
module_param(amount, uint, S_IRUGO);
MODULE_PARM_DESC(times, "Amount of outputting Hello worlds");

static int __init hello_init(void)
{
    uint i = 0;

    if (amount == 0) {
        printk(KERN_WARNING "Entered parameter equals 0");
    } else if (amount >= 5 && amount <= 10) {
        printk(KERN_WARNING "Entered parameter is between 5 and 10");
    } else if (amount > 10) {
        printk(KERN_ERR "Entered parameter is bigger than 10");
        return -EINVAL;
    }

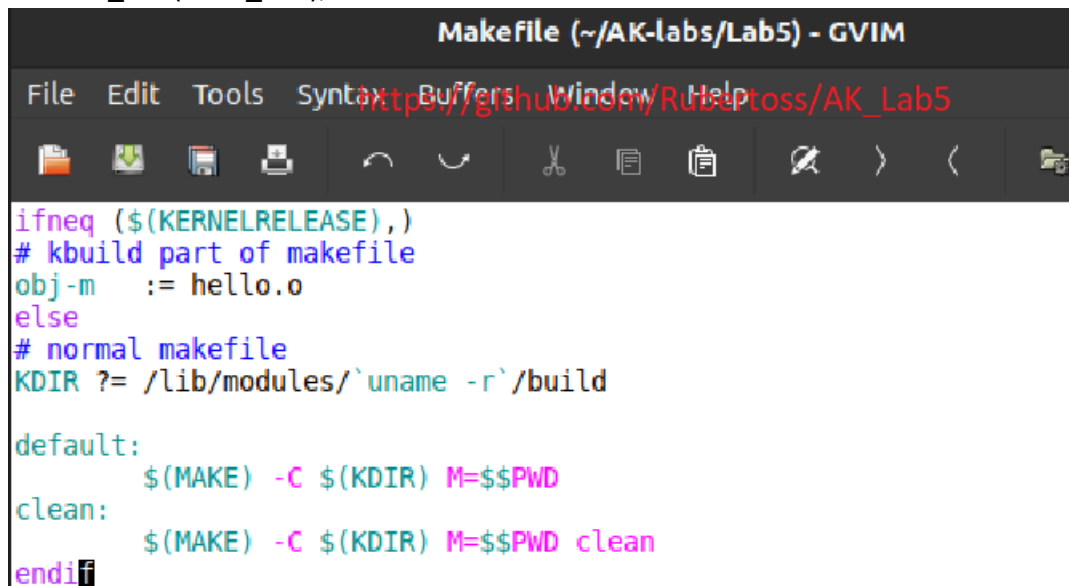
    for (i = 0; i < amount; i++) {
        printk(KERN_EMERG "Hello, world!\n");
    }

    printk(KERN_INFO "Amount: %d\n", amount);

    return 0;
}

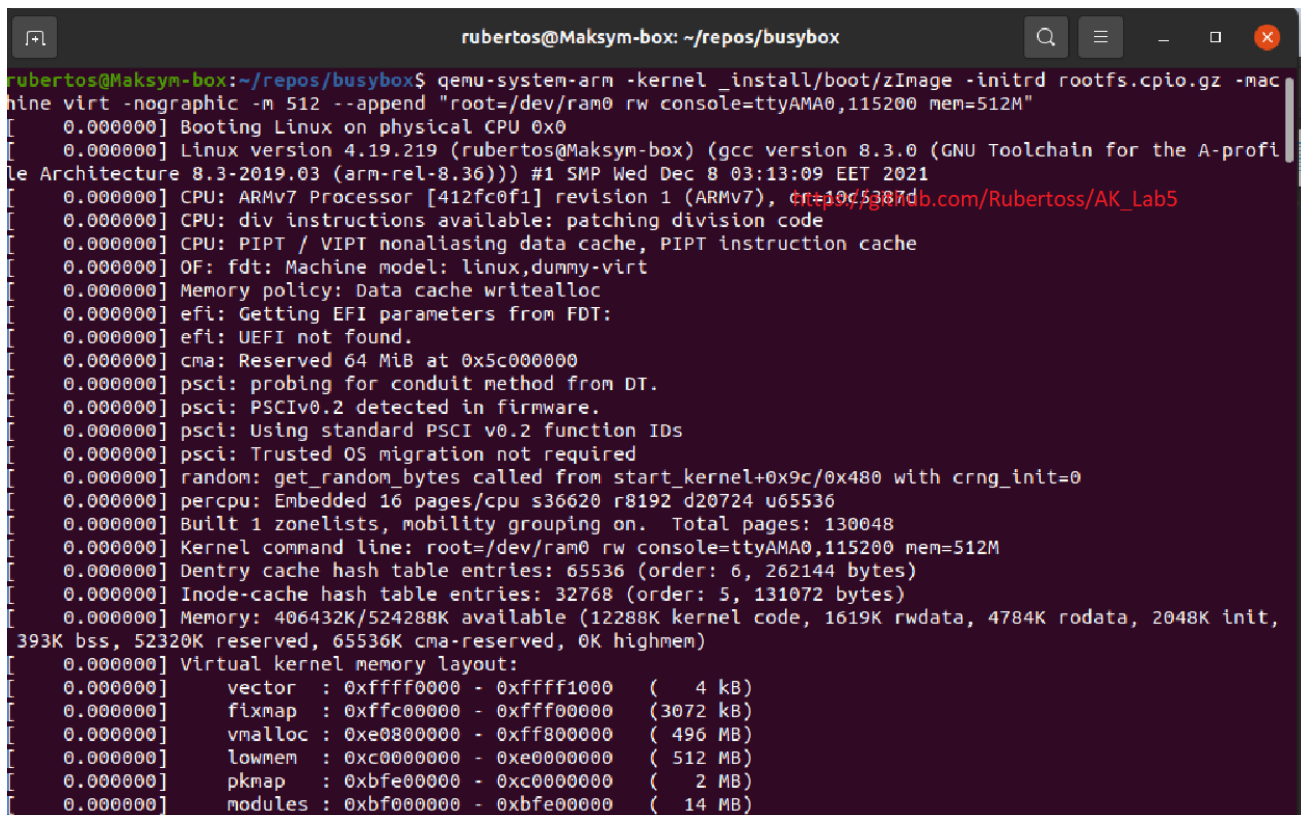
static void __exit hello_exit(void)
{
    /* Do nothing */
}
```

```
module_init(hello_init);
module_exit(hello_exit);
```



```
Makefile (~/.AK-Labs/Lab5) - GVIM
File Edit Tools Syntax Buffers Window Help
https://github.com/Rubertoss/AK_Lab5
ifneq ($(KERNELRELEASE),)
# kbuild part of makefile
obj-m := hello.o
else
# normal makefile
KDIR ?= /lib/modules/`uname -r`/build

default:
$(MAKE) -C $(KDIR) M=$$PWD
clean:
$(MAKE) -C $(KDIR) M=$$PWD clean
endif
```



```
rubertos@Maksym-box: ~/repos/busybox
rubertos@Maksym-box:~/repos/busybox$ qemu-system-arm -kernel _install/boot/zImage -initrd rootfs.cpio.gz -mac
hine virt -nographic -m 512 --append "root=/dev/ram0 rw console=ttyAMA0,115200 mem=512M"
[ 0.000000] Booting Linux on physical CPU 0x0
[ 0.000000] Linux version 4.19.219 (rubertos@Maksym-box) (gcc version 8.3.0 (GNU Toolchain for the A-profile
le Architecture 8.3-2019.03 (arm-rel-8.36))) #1 SMP Wed Dec 8 03:13:09 EET 2021
[ 0.000000] CPU: ARMv7 Processor [412fc0f1] revision 1 (ARMv7), cr=10c5387d
[ 0.000000] CPU: div instructions available: patching division code
[ 0.000000] CPU: PIPT / VIPT nonaliasing data cache, PIPT instruction cache
[ 0.000000] OF: fdt: Machine model: linux,dummy-virt
[ 0.000000] Memory policy: Data cache writealloc
[ 0.000000] efi: Getting EFI parameters from FDT:
[ 0.000000] efi: UEFI not found.
[ 0.000000] cma: Reserved 64 MiB at 0x5c000000
[ 0.000000] psci: probing for conduit method from DT.
[ 0.000000] psci: PSCIv0.2 detected in firmware.
[ 0.000000] psci: Using standard PSCI v0.2 function IDs
[ 0.000000] psci: Trusted OS migration not required
[ 0.000000] random: get_random_bytes called from start_kernel+0x9c/0x480 with crng_init=0
[ 0.000000] percpu: Embedded 16 pages/cpu s36620 r8192 d20724 u65536
[ 0.000000] Built 1 zonelists, mobility grouping on. Total pages: 130048
[ 0.000000] Kernel command line: root=/dev/ram0 rw console=ttyAMA0,115200 mem=512M
[ 0.000000] Dentry cache hash table entries: 65536 (order: 6, 262144 bytes)
[ 0.000000] Inode-cache hash table entries: 32768 (order: 5, 131072 bytes)
[ 0.000000] Memory: 406432K/524288K available (12288K kernel code, 1619K rwdara, 4784K rodata, 2048K init,
393K bss, 52320K reserved, 65536K cma-reserved, 0K highmem)
[ 0.000000] Virtual kernel memory layout:
[ 0.000000] vector : 0xffff0000 - 0xffff1000 ( 4 kB)
[ 0.000000] fixmap : 0xffc00000 - 0xffff0000 (3072 kB)
[ 0.000000] vmalloc : 0xc0000000 - 0xff800000 ( 496 MB)
[ 0.000000] lowmem : 0xc0000000 - 0xe0000000 ( 512 MB)
[ 0.000000] pkmap : 0xbfe00000 - 0xc0000000 ( 2 MB)
[ 0.000000] modules : 0xbf000000 - 0xbfe00000 ( 14 MB)
```

```
rubertos@Maksym-box: ~/repos/busybox
/ # modinfo hello.ko
filename:      hello.ko
author:       Maksym Manchuk IB-93
description:   Computer Architecture Lab5https://github.com/Rubertoss/AK\_Lab5
license:      Dual BSD/GPL
parm:         times:Amount of outputting Hello worlds
depends:
vermagic:     4.19.219 SMP mod_unload ARMv7 p2v8
/ # insmod hello.ko amount=10
[ 101.429699] hello: loading out-of-tree module taints kernel.
[ 101.441007] Entered parameter is between 5 and 10
[ 101.441040] Hello, world!
[ 101.446861] Hello, world!
[ 101.447694] Hello, world!
[ 101.448438] Hello, world!
[ 101.449168] Hello, world!
[ 101.449868] Hello, world!
[ 101.450546] Hello, world!
[ 101.450857] Hello, world!
[ 101.451307] Hello, world!
[ 101.451616] Hello, world!
[ 101.451973] Amount: 10
/ # rmmod hello.ko
/ # insmod hello.ko amount=15
insmod: can't insert 'hello.ko': invalid parameter
/ # insmod hello.ko amount=2
[ 298.560268] Entered parameter is bigger than 10
[ 301.968778] Hello, world!
[ 301.970990] Hello, world!
[ 301.971737] Amount: 2
/ # rmmod hello.ko
/ #
```